DUMONT

CATHODE-RAY OSCILLOGRAPH

TYPE 340 and 341

Allen B. Du Mont Laboratories, Inc.

INSTRUMENT DIVISION

760 BLOOMFIELD AVENUE, CLIFTON, N. J., U. S. A.

Obviously, the design of any scientific instrument results from a series of compromises which represent the designer's opinion of an ideal instrument consistent with contemporary engineering techniques and present-day production possibilities.

In developing this instrument, an attempt has been made to incorporate those characteristics which, we believe, will satisfy the greatest number of applications.

We feel, however, that the real test of any instrument is the opinion of the man who uses it. This day-to-day test of the instrument's advantages and limitations will prove, more than any other method, just what characteristics are desirable.

Because of the nature of the equipment manufactured by Allen B. Du Mont Laboratories, Inc., it is only by complete cooperation between the customer and our Engineering Department that satisfactory designs can be achieved. In a continuous attempt to increase the applicability of our equipment to the problems of the engineer, we sincerely request suggestions advising in what manner the design of this equipment may be further extended to include these problems.

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INSTRUMENT DIVISION
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TABLE OF CONTENTS

page

Section 1

Technical Summary 1

Section 2

Operation 7

Section 3

Theory of Operation 16

Section 4

Maintenance 25

FIGURE 1-1. DU MONT TYPE 340 CATHODE-RAY OSCILLOGRAPH

section 1
technical summary

1. Introduction

This manual of operating and maintenance instructions covers information on the Types 340, 341 Cathode-ray Oscillographs (bench models, and their associate rack-mounted models.) Electrically, the -R models are identical to their corresponding counterparts; mechanically, they differ in exterior appearance. These differences are clearly indicated in the text. Otherwise, references throughout the manual to the Type 340 or Type 341 pertain also to the -R models.

2. Purpose

The Du Mont Types 340 and 341 are qualitative instruments, designed to operate over the present wide range of general-purpose oscillography: from very-low speed, mechanical applications to medium-speed single transients encountered with pulse waveforms. The Types 340 and 341 are similar in appearance and electrical design, but differ in that the Type 341 is designed to have greater vertical and horizontal amplifier band width. The high gain of these instruments assures that they can be used directly with many types of transducers, while d-c amplification provides that the lowest frequency portions of signals will be faithfully reproduced.

3. Features

(1) A mono-accelerator type cathode-ray tube with 1500 V over-all accelerating potential.

(2) Provisions for balanced or single-ended vertical input signals.

(3) Provisions for balanced or single-ended horizontal input signals.

(4) Identical frequency response and gain of both X- and Y- amplifiers extending from d-c to 30% down at 100 kc for the Type 340; down 30% at 600 kc for the Type 341.

(5) Sweep ranges from 2 to 30,000 cps.

(6) Provision for connection of external capacitance provided at rear of instrument for extension of low-frequency sweep range.

(7) Driven or recurrent sweep operation with automatic forward trace brightening.

(8) Type 341 only: Co-axial input connectors at rear of instrument for application of A-C or D-C signals to the vertical or horizontal amplifiers without attenuation.

(9) Examination on screen of any portion of signal expanded up to three times full scale without distortion for the Type 340; up to full scale for the Type 341.

(10) Provision for Z-axis (intensity) modulation.

(11) Provision for direct access to the deflection plates of the cathode-ray tube.

(12) Internally regulated transformer provided to achieve nearly complete freedom from line-voltage changes.

(13) Employment of a single etched-wiring board for essentially all of the circuits results in an exceptionally clean, accessible layout.

4. Circuitry Employed

For a general understanding of the electrical circuits incorporated in this oscillograph, refer to the over-all functional block diagram, Figure 1-2. A detailed explanation of the circuit operation will be found in Section III, Theory of Operation.

5. Technical Summary

The electrical and physical characteristics of the Types 340 and 341 are listed in Table 1-1, Technical Summary Sheet, which follows:

TABLE 1-1
TECHNICAL SUMMARY SHEET

CHARACTERISTICS	TYPE 340	TYPE 341
CATHODE-RAY TUBE		
Type	5AQP–	Same
Total Acceleration Potential	1500 volts	Same

TABLE 1-1 TECHNICAL SUMMARY SHEET (Continued)

CHARACTERISTICS	TYPE 340	TYPE 341
VERTICAL DEFLECTION CIRCUIT		
Input Coupling		
Through Amplifier		
Single-ended signals		
Y INPUT (front panel) .	Direct or through capacitor of 600-volt rating	Same
Y INPUT (rear panel) ..	Not applicable	Direct or through capacitor of 600-volt rating; coaxial connector is available at rear of instrument
Balanced signals	Available at 0.1 D-C position of Y SELECTOR switch	Available at 1.0 D-C position of Y SELECTOR switch
Direct to Deflection Plates .	Direct connection can be made when provision is made to maintain an average d-c potential of about 250 volts with respect to ground on the deflection plates	Same
Maximum Input Voltage ..	600 volts p-p (sum of signal plus d-c)	Same
Input Impedance		
Amplifier		
Single-ended		
Y INPUT (front panel)	2.0 megohms ±5%, 50 μμf max	Same
Y INPUT (rear panel)	Not applicable	2.0 megohms ±5%, 70 μμf max
Balanced	2.0 megohms ±5%, 50 μμf max each side to ground	Same
Direct to Defl Plates		
Single-ended	No greater than 5 megohms (Defl Plate return resistors are not supplied)	Same
Balanced	No greater than 10 megohms center-tapped to ground (Defl-plate return resistors are not supplied)	Same
Deflection Factor		
Amplifier (at full gain)	0.1 volt peak-to-peak full scale or 0.025 peak-to-peak volt/inch (0.0085 rms volt/inch) nominal	0.400 volt p-p full scale; or 0.100 peak-to-peak volt/in. (0.035 rms volt/inch) nominal
Deflection plates	19 to 23 peak-to-peak volts/inch (6.7 to 8.1 rms volts/inch)	Same
Undistorted deflection	At least 4 inches. On-screen portions of expanded pattern, up to 3 times full screen, will have negligible distortion.	At least 4 inches
Sinusoidal Frequency Response (Referred to sensitivity at 1 kc)		
High frequency	Down not more than 30% at 100 kc	Down not more than 30% at 600 kc

TABLE 1-1 TECHNICAL SUMMARY SHEET (Continued)

CHARACTERISTICS	TYPE 340	TYPE 341
Low frequency		
Direct coupled	Flat to d-c	Same
Capacitively coupled		
Y INPUT (front panel)	Down not more than 10% at 2 cycles	Same
Y INPUT (rear panel)	Not applicable	Down not more than 10% at 20 cycles
Pulse Response (to a step function)		
Rise time	3.5 μs or less	0.6 μs or less
Overshoot	2% or less	Same
Decay at top		
Direct coupled		
Y INPUT (front panel)	None	Same
Y INPUT (rear panel)	Not applicable	None
Capacitively coupled		
Y INPUT (front panel)	10% in 21 milliseconds nominal	Same
Y INPUT (rear panel)	Not applicable	10% in 2.1 milliseconds nominal
HORIZONTAL DEFLECTION CIRCUIT (Identical to vertical deflection circuit except as shown)		
Deflection Factor		
Amplifier (at full gain)	0.128 volts peak-to-peak full scale or 0.032 peak-to-peak volt/inch (0.01 rms volt/inch) nominal	0.5 volt peak-to-peak full scale or 0.125 peak-to-peak volt/inch (0.045 rms volt/inch) nominal
Deflection plates	24 to 30 peak-to-peak volts/inch (8.5 to 10.6 rms volts/inch)	Same
X-Y Amplifier Relative Phase Shift Characteristics	See nested table below	Relative phase shift will not exceed 1° below 600 kc with X & Y amplifier gains equalized; less than 3° for any X & Y AMPLITUDE control settings
Linear-sweep Time Base Circuit	Vacuum tube sweep, driven or recurrent as desired	Same
Sweep Frequency		
Internal	Will display one cycle (minimum) of a 2-cycle/sec signal; 30,000 cps (maximum)	Same

(X) & (Y) Amplitude Settings	Relative Phase Shift		
	to 10 kc	to 50 kc	to 100 kc
Maximum	–	<3.5°	–
Any combination	<3.5°	–	<20°
Minimum relative phase shift	–	–	< 1°

section 1
technical summary

TABLE 1-1 TECHNICAL SUMMARY SHEET (Continued)

CHARACTERISTICS	TYPE 340		TYPE 341
External	EXT CAP connector is provided (rear panel) for slower sweeps. For each microfarad of external capacitance approximately 5 seconds of sweep time is secured.		Same
Sweep Expansion	20 inches maximum		Full screen maximum
Horizontal Positioning	Sufficient to position any full scale portion of the expanded sweep or X INPUT signal may be examined on the screen		Sufficient to position full scale X INPUT signal on screen
Sweep Linearity	Any 10% increment is within 10% of any other 10% increment except for the top half of the highest sweep range where the linearity may degrade to 20%		Same
Sweep Beam Gate	Automatic beam brightening during forward sweep. Beam is not visible during sweep retrace or while sweep is at rest. INTENSITY control overrides blanking for X amplifier use. Gate is not disabled when using X amplifier for external signals as long as sweep is not disabled		Same
Synchronization			
Sources	Positive or negative INTernal, power LINE, or EXTernal signals		Same
Sync Sensitivities	DRIVEN SWEEP will trigger on		Same
	INTernal Sync	EXTernal Sync	
Sawtooth signal	Slope greater than 6 in/sec	Slope greater than 60V/sec	
Pulse Signal	0.4 inch of vertical deflection minimum	4 volts; duration greater than 0.2 μs	
Sine Wave signal			
3 cycles to 100 kc	0.4 inch of vertical deflection minimum	4 volts p–p minimum	
Up to 250 kc	Greater than 0.4 inch of vertical deflection	Greater than 4 volts p–p	
Up to 500 kc (RECUR SWEEP only)	Recurrent sweep can be synchronized internally with 0.4 inch or greater of vertical deflection, or externally with 4 volts p-p		

TABLE 1-1 TECHNICAL SUMMARY SHEET (Continued)

CHARACTERISTICS	TYPE 340	TYPE 341
INTENSITY MODULATION CIRCUIT		
Availability	Plug on rear panel	Same
Input Impedance	30,000 ohms, 30 μμf	Same
Polarity	Positive signals decrease beam intensity	Same
TEST SIGNAL		
Availability	Front-panel terminal	Same
Amplitude	Sufficient for full-screen deflection	Same
Frequency	Power line	Same
POWER REQUIREMENTS (Includes self-regulating transformer)		
Primary-power Potential	115 volts ± 10%, single phase	Same
*Primary-power Frequency	60 cycles only	Same
Primary Power	100 watts	Same
Fuse Protection		
Primary fuse	2 amperes	Same
Secondary fuses		
LV power supply	0.15 ampere	Same
Heaters	6.25 amperes	Same

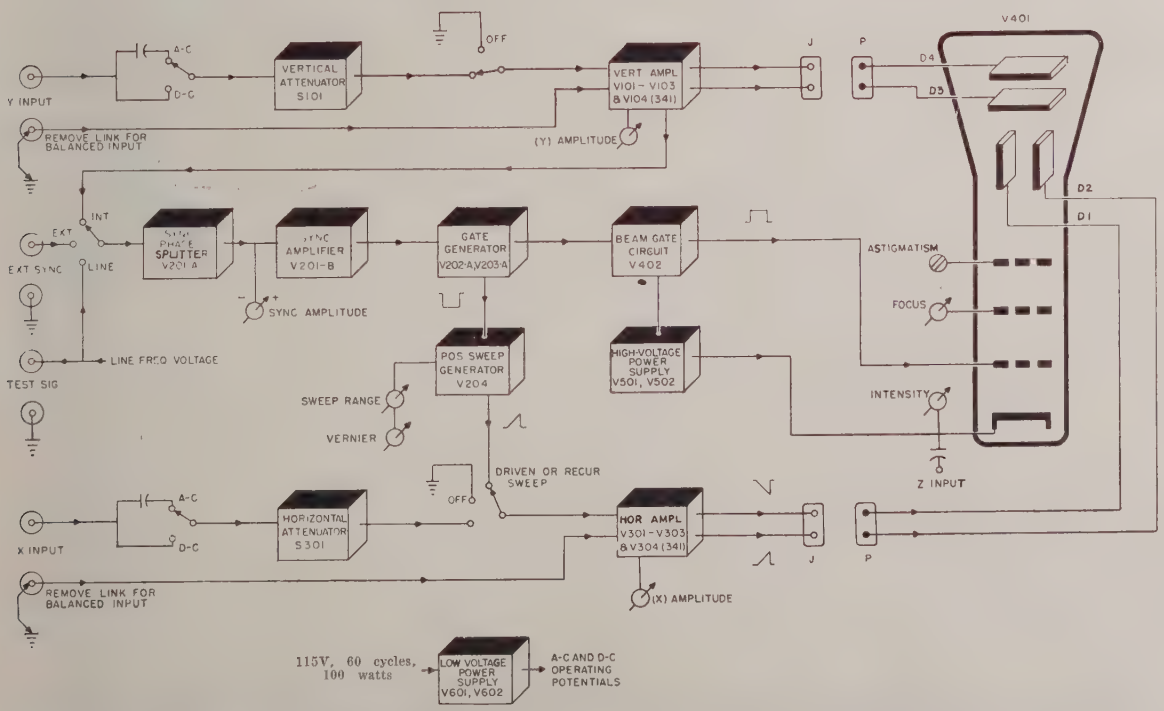
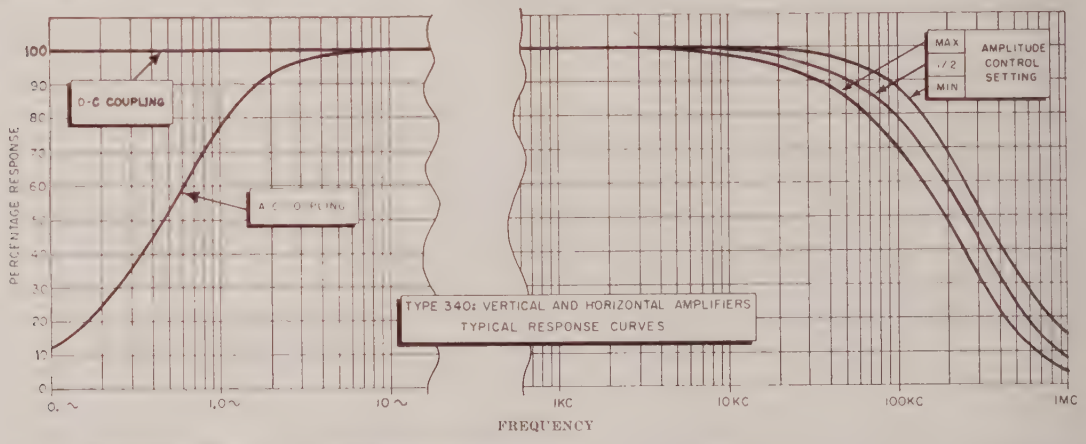


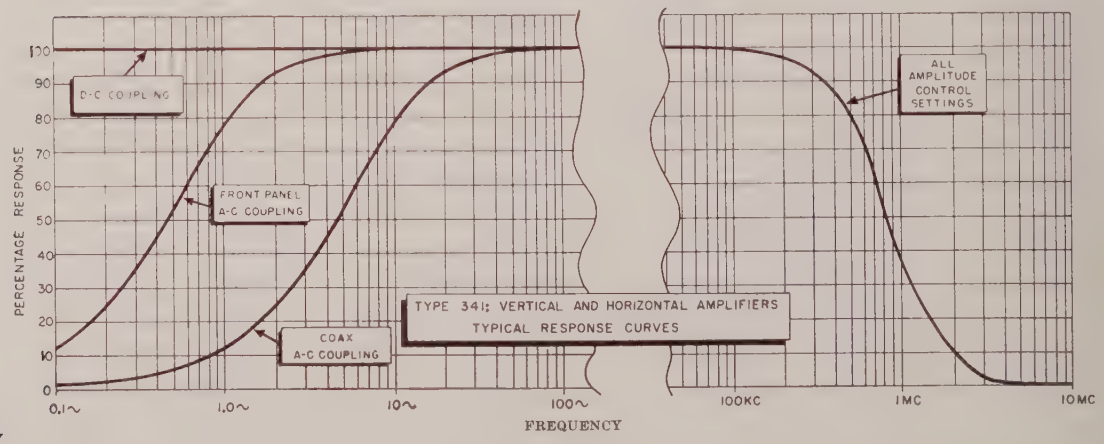
FIGURE 1-2. OVER-ALL FUNCTIONAL BLOCK DIAGRAM TYPE 340/341 CATHODE-RAY OSCILLOGRAPH

section 1
technical summary

TABLE 1-1 TECHNICAL SUMMARY SHEET (Continued)

CHARACTERISTICS	TYPE 340		TYPE 341
	Type 340	Type 340-R	
PHYSICAL CHARACTERISTICS			
Height	13¾ inches	8¾ inches	Types 341 and 341-R dimensions are same as 340 and 340-R respectively
Width	9 inches	19 inches	
Depth	18¾ inches	18¾ inches	
Weight	approx. 40 pounds	same	
*A unit with a non-regulating transformer for use from 50 to 400 cycles with reduced stability will also be available.			
TUBE COMPLEMENT			
Quantity and Type	1–0A2 1–1X2A 1–5AQP– 1–5Y3–GT 1–6AQ5	2–6BK7–A 2–6U8 1–12AT7 5–12AU7 1–12AX7	Same except as follows: 7–12AU7
Total Number	16		18





section 2
operation

1. Unpacking, Inspection and Installation

The Du Mont Types 340 and 341 Cathode-ray Oscillographs are shipped with all tubes in place and ready to operate. Upon receipt, and prior to operation, the Type 340 or 341 should be inspected for any damage incurred in shipment. To remove the instrument from its cabinet, remove the two screws at the back of the cabinet and slide the instrument forward, taking care that the line cord is free to slide through the hole provided. For the –R models, in addition to the rear screws, remove the four outermost front-panel screws located at the top and bottom center, and the left and right center. Slide the instrument forward while observing the previously mentioned precaution.

Since the Types 340 and 341 are portable test instruments, no special installation procedure is required. The –R models have a front panel 19 inches wide by 8¾ inches high for mounting the instrument in a standard relay rack or cabinet.

Normally the Type 340 or 341 may be placed where most convenient for viewing while at the same time maintaining short signal leads. Although shielding has been provided, operation in very strong magnetic fields may cause spurious deflections and should be avoided. Reorientation or additional shielding of the instrument may be necessary to minimize the effects of such fields.

The power transformers in these instruments are intended for operation from a 100–130 V 60-cycle power source only. A variation of 1% in the line frequency will change the secondary voltages delivered by the transformer by about 2%.

Warning

Potentials as high as 1500 volts are employed in these instruments. Such voltages are extremely dangerous; and every possible safety precaution should be taken to avoid contact with them. The instrument is not a hazard when completely enclosed in its cabinet or dust cover. It should not be operated with the cabinet or dust cover removed except for purposes of adjustment or repair, at which time precautions should be taken as described in Section 4, Maintenance.

2. Front-Panel Facilities (See Figure 2-1)

The front-panel markings are essentially self explanatory, and after carefully studying Table 2–1, which lists the functions of the various controls and terminals, the operator should find it possible to master the controls with a minimum of experimentation. Detailed instructions on the operation of the controls to make use of all the features of the instrument are given in subsequent paragraphs.

TABLE 2-1
FRONT-PANEL FACILITIES

NAME	FUNCTION
INTENSITY	Control: varies the trace brightness
FOCUS	Control: adjusts the trace sharpness
Y POSITION	Control: positions the trace vertically
X POSITION	Control: positions the trace horizontally
X D–C BAL	Control: when properly adjusted, prevents horizontal movement of the trace when the (X) AMPLITUDE control is varied; also, for the Type 340, used to position the trace for center-screen expansion
Y D–C BAL	Control: when properly adjusted, prevents vertical movement of the trace when the (Y) AMPLITUDE control is varied
SYNC SELECTOR	Control: selects source of sweep synchronizing signals (EXT, LINE and INT)
SYNC AMPLITUDE	Control: selects polarity and adjusts the amplitude of sweep synchronizing signals

section 2
operation

FIGURE 2-1. FRONT-PANEL FACILITIES

TABLE 2-1
FRONT-PANEL FACILITIES (Continued)

NAME	FUNCTION
Y SELECTOR (Y) AMPLITUDE	Concentric controls: Type 340: outer knob—Y SELECTOR—selects signals, either A-C or D-C coupled, from the Y INPUT terminal for application to the vertical amplifier. Front-panel markings indicate approximate voltages for full scale deflections (0.1, 1, 10 and 100) Type 341: outer knob—Y SELECTOR—selects signals, either A-C or D-C coupled, from the Y INPUT terminal or from the COAXial connector (rear-panel) for application to the vertical amplifier. Front-panel markings indicate no-signal attenuation (COAX or 1), or attenuation of applied signals by factors of 10 or 100 Type 340/341: inner knob—(Y) AMPLITUDE—provides continuous amplitude variation of vertical deflection
X SELECTOR (X) AMPLITUDE	Concentric controls: Type 340/341: outer knob—X SELECTOR—same as Y SELECTOR except that X INPUT signals are applied to the horizontal amplifier and internal signals (DRIVEN or RECUR SWEEP) may be selected Type 340/341: inner knob—(X) AMPLITUDE—provides continuous amplitude variation of horizontal deflection
SWEEP RANGE VERNIER	Concentric controls: Outer knob—SWEEP RANGE—Varies sweep frequency in steps. EXT CAP position provides for connection of external capacitance for low-frequency sweep Inner knob—VERNIER—provides continuous variation of sweep frequency within the approximate limits established by the setting of the SWEEP RANGE control
Y INPUT	Binding posts: connections for external signals to the vertical amplifier, either balanced or single ended
X INPUT	Binding posts: connections for external signals to the horizontal amplifier, either balanced or single ended, except when X SELECTOR is set at DRIVEN or RECURrent SWEEP
EXT SYNC	Binding posts: provides for connection of external synchronizing signals to the EXT position of the SYNC SELECTOR switch
TEST SIG	Binding posts: provides line-frequency signal output for external test purposes
POWER ON	Toggle switch: applies primary power to the instrument

REAR-PANEL FACILITIES

(Accessible at Rear of Cabinet or Dust Cover)

X DIR	Plug: provides for direct connections of signals to horizontal deflection plates
EXT CAP	Plug: connection for an external capacitor when X SELECTOR is set to EXT CAP

REAR-PANEL FACILITIES (Continued)

(Accessible at Rear of Cabinet or Dust Cover)

Z AXIS	Plug: provides for connection of external signals to intensity modulate the trace
Y DIR	Plug: provides for direct connection signals to vertical deflection plates
Y INPUT	Type 341 Coaxial connector: connection for external single-ended signals to the vertical amplifier.
X INPUT	Type 341 Coaxial connector: connection for external single-ended signals to the horizontal amplifier

3. Precaution Against Screen Burning

A sharply focused spot of high intensity and small area should not be permitted to remain stationary on the screen for any length of time. Under such conditions, the entire beam energy is concentrated over a small area, thus subjecting the screen material to burning and discoloration. This condition is most likely to exist when using the driven mode of sweep operation, with the INTENSITY turned up, and no signal input. Always keep the INTENSITY low and never allow a spot to remain stationary on the screen.

4. Energizing the Equipment

To place the instrument in operation, plug the power cord into the line outlet, and turn ON the POWER switch. Allow approximately one minute for the instrument to warm up; in the meantime, set the various controls as indicated in Table 2-2, which follows:

5. Preliminary Adjustments

Center the spot with X POSITION and Y POSITION controls. If the spot moves as the (Y) AMPLITUDE control is rotated, the Y D-C BAL control should be adjusted in the following manner:

Step 1. Make sure that Y SELECTOR is OFF and set (Y) AMPLITUDE fully CCW

Step 2. Center the spot with Y POSITION control

Step 3. Set (Y) AMPLITUDE control fully CW

TABLE 2-2
PRELIMINARY CONTROL SETTINGS

CONTROL	POSITION
Y POSITION, X POSITION	center of range
INTENSITY, FOCUS	center of range
Y SELECTOR	OFF
(Y) AMPLITUDE	center of range
SYNC SELECTOR	INT
SYNC AMPLITUDE	fully CCW
X SELECTOR	RECUR SWEEP
(X) AMPLITUDE	fully CCW
SWEEP RANGE	50–250
VERNIER	center of range

Step 4. Recenter the spot with Y D-C BAL control

Step 5. Repeat steps 1 through 4 until no vertical displacement of the spot is observed while varying the (Y) AMPLITUDE control throughout its range. Note: If satisfactory balance cannot be achieved, replace V101 (Type 340) or V104 (Type 341). These are preselected tubes and may prove critical in replacement. The Du Mont Instrument Service Department can supply these selected tubes.

Patch the TEST SIG to the Y INPUT terminals. Set Y SELECTOR to 0.1 (Type 340) or 1 (Type 341) and adjust (Y) AMPLITUDE to obtain a vertical deflection of about two inches. Rotate the INTENSITY control clockwise to obtain a trace having normal brightness and set the FOCUS control for best definition. Next, adjust (X) AMPLITUDE to expand the trace. If display tends to move off screen, either to the left or right, adjust X D-C BAL to position the pattern back on screen. Finally, adjust SYNC AMPLITUDE and (SWEEP) VERNIER controls for a stable pattern about three inches wide. Remove patching cord at conclusion of tests.

6. Operating Hints for the Sweep Circuit

a. DRIVEN SWEEP

Refer to the Technical Summary Sheet, Table 1-1, for information on sync sensitivities, and to the Front-panel Facilities, Table 2-1, for information on control functions.

A stable pattern for practically all types of signals can be obtained by using driven sweep; its use is mandatory for viewing random or aperiodic signals or periodic signals of low duty cycle. When operating the instrument in this manner, one sweep occurs for each signal impulse or submultiple thereof. Use of the driven sweep mode of operation, in the majority of applications, is the condition under which optimum performance can be expected of this equipment.

When the oscillograph is set for driven sweep, the spot will be visible only during forward sweep time, provided the INTENSITY control is not set too far clockwise.

Table 2-3 lists the control settings and adjustment procedures for driven sweep operation.

b. CENTER-SCREEN EXPANSION

Signal expansion is symmetrical, linear, and always occurs about the point determined by the setting of the X POSITION control. Proper adjustment of this control is made when the (X) AMPLITUDE control is set *fully CCW*. The X D-C BAL control is employed to *position* the desired portion of the pattern on the screen for expansion.

To expand a given waveform about the screen center, preset the controls as indicated in Table 2-3 and follow the instructions outlined under "Procedure." Note: X SELECTOR may also be set at RECUR SWEEP for signal expansion. Next, position the desired portion of the waveform for expansion to the center of the screen with the X D-C BAL control and expand the entire display with the (X) AMPLITUDE control. This feature eliminates the need to reposition the desired information back on the screen after expansion. In addition, it also permits externally calibrated time measurements by repositioning the expansion point, with the X POSITION control, two inches to the left of center.

c. RECURRENT SWEEP

In some applications it is desirable to have the sweep free-running, whether synchronized or not. To achieve this condition proceed as follows: Set up the controls as indicated in Table 2-3 except that X SELECTOR is set at RECUR SWEEP.

One advantage of this mode of operation, is the ability of the sweep to be synchronized to high-frequency repetitive functions beyond that of driven sweep operation. Another advantage is the display of non-synchronous waveforms.

d. EXTENSION OF LOW-FREQUENCY SWEEPS

Provision is made for connecting external capacitors to the EXT CAP plug (rear panel) to obtain lower speed sweeps than provided for in the instrument. The lowest sweep frequency obtainable without resorting to external capacitors is about two cycles per second. For lower speed sweeps, proceed as follows: Set SWEEP RANGE control at EXT CAP and connect an external capacitor to the EXT CAP Two-pin plug provided at the rear of the instrument. For each microfarad of external capacitance, approximately five seconds of sweep time is secured. Note: A high-leakage-resistance capacitor of the highest possible quality, such as a paper dielectric type, should be employed to preserve sweep linearity. (CAUTION: EXT CAP terminals are approximately 150 volts above ground)

7. Operating Hints for the Vertical Amplifier

a. Y D-C BAL ADJUSTMENT

When this control is properly adjusted, there will be no vertical displacement of the trace with changes in the setting of the (Y) AMPLITUDE

TABLE 2-3
INITIAL CONTROL SETTINGS FOR DRIVEN SWEEP OPERATION

CONTROL	INITIAL SETTING
X SELECTOR	DRIVEN SWEEP
(X) AMPLITUDE	Fully CCW
Y SELECTOR	Set as determined by amplitude of signal source or at 0.1 (Type 340) or 1 (Type 341), AC- or D-C
(Y) AMPLITUDE	Fully CCW
SYNC AMPLITUDE	0
INTENSITY and FOCUS	Approximately 1/3 CW
X POSITION and Y POSITION	Center of range

PROCEDURE
a. Apply the desired signal to Y INPUT
b. Adjust SYNC AMPLITUDE to + or – (to initiate the sweep) and rotate X POSITION to center the vertical trace (line) horizontally
c. Adjust (Y) AMPLITUDE in conjunction with Y SELECTOR to obtain a vertical deflection of about two inches.
d. Gradually adjust X AMPLITUDE to expand the trace. If display tends to move off screen, either to the left or right, adjuts X D-C BAL to position the pattern back on screen
e. Rotate the SWEEP RANGE and VERNIER controls to obtain the desired number of cycles on screen. Readjust SYNC AMPLITUDE if necessary
f. Adjust the INTENSITY and FOCUS controls to obtain a sharp trace at a suitable brightness level
g. If there is any multiple triggering of the sweep, the SYNC AMPLITUDE control may be corrected to select the signal level which will best actuate the gate circuit. Thus, any intervening variations of lesser amplitude will not affect the sweep

control. For adjustment procedure, see paragraph entitled "Preliminary adjustments."

b. SINGLE ENDED Y INPUT

Signals to be observed are connected to the vertical channel through the Y INPUT terminal and ground. For the Type 341 only, signals may also be connected to the COAX terminal (rear panel) for application to the vertical amplifier. The Y SELECTOR permits capacitive or direct coupling of the signal to the compensated attenuator. The terminals for direct connection to the cathode-ray tube are accessible at the rear of the cabinet or dust cover. (See paragraph 9 for details.)

c. USE OF BALANCED INPUT (See Figure 2-2)

For balanced input, remove the link from the normally grounded Y INPUT terminal. The Y SELECTOR must be set to the 0.1 D-C position for the Type 340; for the 341, the 1 D-C position. The following explanation of the balanced-input feature may help the operator to determine when this type of operation may be useful or desirable.

If there is an in-phase signal applied to both inputs (known as a "common-mode" signal) superimposed on the balanced-input signal, the maximum input signal (d-c plus peak signal a-c) will be accordingly reduced.

One of the features of the balanced-input circuit is the differential action of the amplifier. This circuit makes it possible to reject to a considerable degree any common-mode signal, while at the same time passing and amplifying the balanced-input signal. Thus, if there is any pickup of noise on test leads or in the equipment under test, such noise will be reduced materially on passing through the balanced-input amplifier circuit.

The waveforms shown in Figure 2-2 illustrate the advantage of the balanced-input connection over the single-ended in such cases. A push-pull test signal on which a common "nuisance" signal is superimposed, is applied to the balance-input connection of the instrument (Figure 2-2a). Then, this same signal, passed through a network to convert it to unbalanced output, is applied to the unbalanced-input connection of the instrument (Figure 2-2b). Note how much greater the amplitude of the common-mode signal appears with the unbalanced-input connection.

8. Operating Hints for the Horizontal Amplifier

a. GENERAL

The Types 340 and 341 both contain identical horizontal and vertical amplifiers. This results in very small relative phase shift between X and Y signals, provided that the (X) and (Y) AMPLITUDE controls are set comparably. See Table 1-1 for additional information. For those applications where it is desirable to apply an external signal through the horizontal amplifier, the amplifier should first be adjusted for d-c balance as outlined in the next paragraph.

b. X D-C BAL ADJUSTMENT

When this control is properly adjusted, there will be no horizontal displacement of the spot with changes in the setting of the (X) AMPLITUDE control. To adjust, proceed as follows:

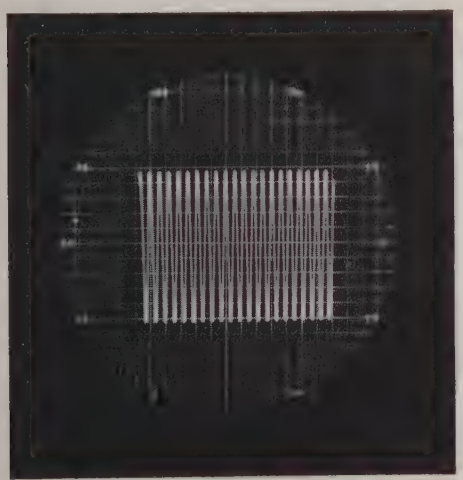
Step 1. Set X SELECTOR at OFF and (X) AMPLITUDE fully CCW

Step 2. Center the spot with X POSITION control

Step 3. Set (X) AMPLITUDE control fully CW

Step 4. Recenter the spot with X D-C BAL control

Step 5. Repeat steps 1 through 4 until no horizontal displacement of the spot is observed while varying the (X) AMPLITUDE control throughout its range. Note: If satisfactory balance cannot be achieved replace V301 (Type 340) or V304 (Type 341). These are preselected tubes and may prove critical in replacement. The Du Mont Instrument Service Department can supply these selected tubes.



(a) Test Signal Applied to Balanced Input

(b) Test Signal Applied to Unbalanced Input

Figure 2-2. EFFECTIVENESS OF BALANCED INPUT IN ELIMINATING "COMMON-MODE" SIGNALS.

c. X INPUT

When using the horizontal amplifier for external signals (X INPUT), set X SELECTOR to A-C or D-C. When this switch is set to either of these positions, the internal sweep is disconnected and the X INPUT terminals are connected to the horizontal amplifier. However, the sweep gate circuit is not disabled unless the SYNC AMPLITUDE is set at "0." Application of singled-ended or balanced signals to X INPUT is identical to that described for the vertical amplifier.

d. X AMPLIFIER GATED BEAM OPERATION

If gated-beam operation is desired when using both the vertical and horizontal amplifiers, it can be obtained by triggering the sweep (which is placed in the driven mode when the X SELECTOR is set for external signals) with EXT, INT, or LINE signals just as in normal operation. Thus, it is possible while viewing external signals, to superimpose the brightening gate on the trace. The duration of the brightening gate may be adjusted by the SWEEP RANGE and VERNIER controls. If this feature is not desired, set SYNC AMPLITUDE at "0."

9. Direct Connection to Deflection Plates

a. GENERAL

When applying signals to deflection plates, the highest-frequency signal that can be observed is not limited by the response of the built-in amplifiers but is dependent upon input capacitance to the deflection plate terminals and/or transit time of the electrons between the deflection plates. Provided the impedance of the signal source is kept low, transit time is the only consideration. It should be remembered, however, that no amplification or attenuation is provided on "direct input" and that approximately 24 D-C or P-P volts are required to produce an inch of deflection.

b. MAKING PROPER CONNECTIONS

Caution

Before making connections, shut off power.

Direct connection to the deflection plates can be made by removing the appropriate twin lead two-pin plug at the rear of the cabinet, and by noting the following information:

(1) Deflection plate return resistors must be provided. Singled-ended input, 5 megohms (maximum) either plate to ground; balanced input, 10 megohms (maximum) center-tapped to ground.

(2) The average d-c potential of approximately 250 volts above ground must be preserved on both pairs of deflection plates.

(3) This average d-c level should be made adjustable to provide an astigmatism control for optimum focus adjustment.

(4) To avoid any possibility of cross-coupling effects, it is suggested that, when connecting a signal direct to deflection plates, the corresponding channel (X SELECTOR and/or Y SELECTOR) controls be switched to OFF.

(5) A loss of positioning will occur.

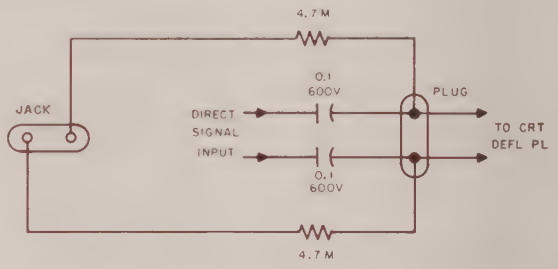


FIGURE 2-3. CIRCUIT FOR DERIVING POSITIONING VOLTAGE FOR SIGNALS COUPLED DIRECT TO DEFLECTION PLATES

c. DERIVING POSITIONING VOLTAGES (See Figure 2-3)

A suggested method of deriving positioning voltages from the horizontal and/or vertical amplifiers is as follows:

Step 1. Disconnect the appropriate CRT deflection-plate from its jack (rear of cabinet).

Step. 2. Bridge the plug and mating jack with a series resistor (4.7 megohms) in each leg. Note: The idle EXT CAP or Z AXIS plug (rear of cabinet) may be employed to facilitate connection of the series bridging resistors.

Step 3. Connect the signal through blocking capacitors of at least 600 volts d-c rating.

Employment of these steps preserves the deflection-plate voltages and obviates the need for return resistors.

10. Intensity Modulation

Positive signals applied to Z input will decrease the beam intensity. To make this connection, shut off the power and apply the signal to the Z AXIS plug at the rear of the instrument. Note: Z input presents an impedance of 30,000 ohms and 30 μμf to the signal source.

11. Making Rise Time Measurements

Application of signals from an external time calibrator will facilitate pulse rise-time measurements. When making such measurements, the one factor which must be borne in mind for most accurate quantitative results is the pulse response characteristic of the vertical amplifier. This characteristic is related to the observed pulse rise time and the actual pulse rise time in the following manner:

$$t_{ro} = \sqrt{t_{ra}^2 + t_{rp}^2}$$

Where t_{ro} is the observed rise time; t_{ra} is the minimum rise time of the amplifier; t_{rp} is the signal rise time. Once the amplifier rise time is known, the rise time of any pulse may be calculated.

Since deflection-plate misalignment is virtually eliminated through the use of tight-tolerance cathode-ray tubes which allow a maximum of 1° of misalignment, no correction for this factor should be necessary.

12. Photographic Recording

Permanent photographic records of oscillograms are readily obtainable. For detailed information on photographic recording of waveforms, the operator is referred to a booklet titled "Techniques of Photo-recording from Cathode-ray Tubes" published by the Instrument Division of Allen B. Du Mont Laboratories, Inc.

As an aid in amplitude and time calibration, both for visual measurements and for permanent records by photographic recording, an illuminated scale over the face of the cathode-ray tube is a desirable adjunct to an oscillograph. The Du Mont Type 2563-Illuminated Scale Kit provides this facility and is available as an accessory.

section 3
theory of operation

1. General

In following the theory discussion, it is suggested that the over-all block diagram in Section I and the over-all circuit schematics (just inside the back cover of the manual) be referred to in addition to the simplified functional block diagrams in this section.

2. Cathode-ray Tube and Beam Gate Circuit (See Figure 3-1)

a. MONO-ACCELERATOR TUBE

The Types 340 and 341 features the new mono-accelerator, high-resolution, tight-tolerance cathode-ray tube (5AQP–). Owing to the unique electronic gun and accelerating system, geometric distortion is greatly reduced and may be virtually ignored in most exacting applications. Excellent spot size, focus and pattern brilliance are readily apparent. This tube is operated at a total accelerating potential of 1500 volts.

b. FOCUS

Focusing of the beam for maximum "sharpness" of trace is accomplished by adjusting the FOCUS control (R411). The setting of this control establishes the relative potential difference between the focus anode and cathode. The vertical deflection plates (D3 and D4) and the horizontal deflection plates (D1 and D2) operate at an average d-c potential of approximately 250 volts above ground. To avoid beam distortion, the second anode must operate at approximately the same d-c potential. The second anode voltage for the Type 340 is derived from the junction of R128 and R129. The voltage at this junction is controlled by the ASTIG ADJ (R118) located in the cathode circuit of V102.

The second anode voltage for the Type 341 is obtained from the arm of the ASTIG ADJ potentiometer (R416).

c. INTENSITY MODULATION

For the purpose of intensity modulating the beam, positive (blanking) or negative (brightening) signals may be applied to the Z AXIS two-pin plug through a coupling capacitor (C402) to the cathode of the cathode-ray tube.

d. R-F POWER SUPPLY (See over-all schematic)

Operating potentials for the proper intensity and focusing of the CRT beam are derived from the r-f power supply. This circuit consists of an r-f power oscillator (V501), an r-f type transformer having a high turns ratio and a powdered iron core (T501) and a –HV diode rectifier (V502). The –1200 V rectified output of the half-wave rectifier (V502) is filtered by a pi-type R-C network (C502, R501 and C501). The high-voltage output is controlled by the HV ADJ (R503) which varies the screen voltage of the r-f power oscillator (V501).

The advantages of r-f supply system of generating CRT accelerating potentials, compared to that of the conventional "brute force," low-frequency systems are:

(1) Elimination of high-voltage, high-capacitance filters which are expensive and bulky.

(2) Sharp reduction in shock hazard because of the smaller capacitors used in the filter system.

e. BEAM GATE AND INTENSITY CIRCUITS (See over-all schematic)

(1) GENERAL DESCRIPTION

The very low sweep frequencies involved in the Types 340 and 341 make it necessary for the CRT to be turned on for the duration of the long sweep interval and then turned off automatically. Since the grid of the CRT is at a high negative voltage and the source of the brightening gate is a potential of approximately +150 volts, some means of transferring this gate, from a low d-c level to a high d-c level, is required. Ordinary capacitive coupling would not be feasible since the very long time-constants involved would indicate the use of a prohibitively large capacitor.

To circumvent this problem, a conventional bistable multivibrator (V402—beam gate generator) is incorporated. The mean d-c level of this stage is equal to the average level of the CRT accelerating potential. Thus, only short pulses are needed to trigger V402 on or off, enabling the use of a much smaller coupling capacitor.

(2) DETAILED DESCRIPTION

Under stable conditions, the constants of the beam gate circuit are such that V402-A is at "cut-off" and V402-B fully conducting. When the sweep starts, the negative leading edge of the gate coupled from the cathode of V203-B is applied to the grid (pin 7) of V402-B, turning off this stage and turning on V402-A. Thus, the grid of the CRT is held above cutoff for the duration of the forward sweep time. V402 is restored to its original condition by the positive-going trailing edge of the sweep gate.

The intensity of the beam is adjusted by varying the INTENSITY control (R413). This control varies the cathode potential more or less positive with respect to the grid, which is held at a mean fixed negative potential.

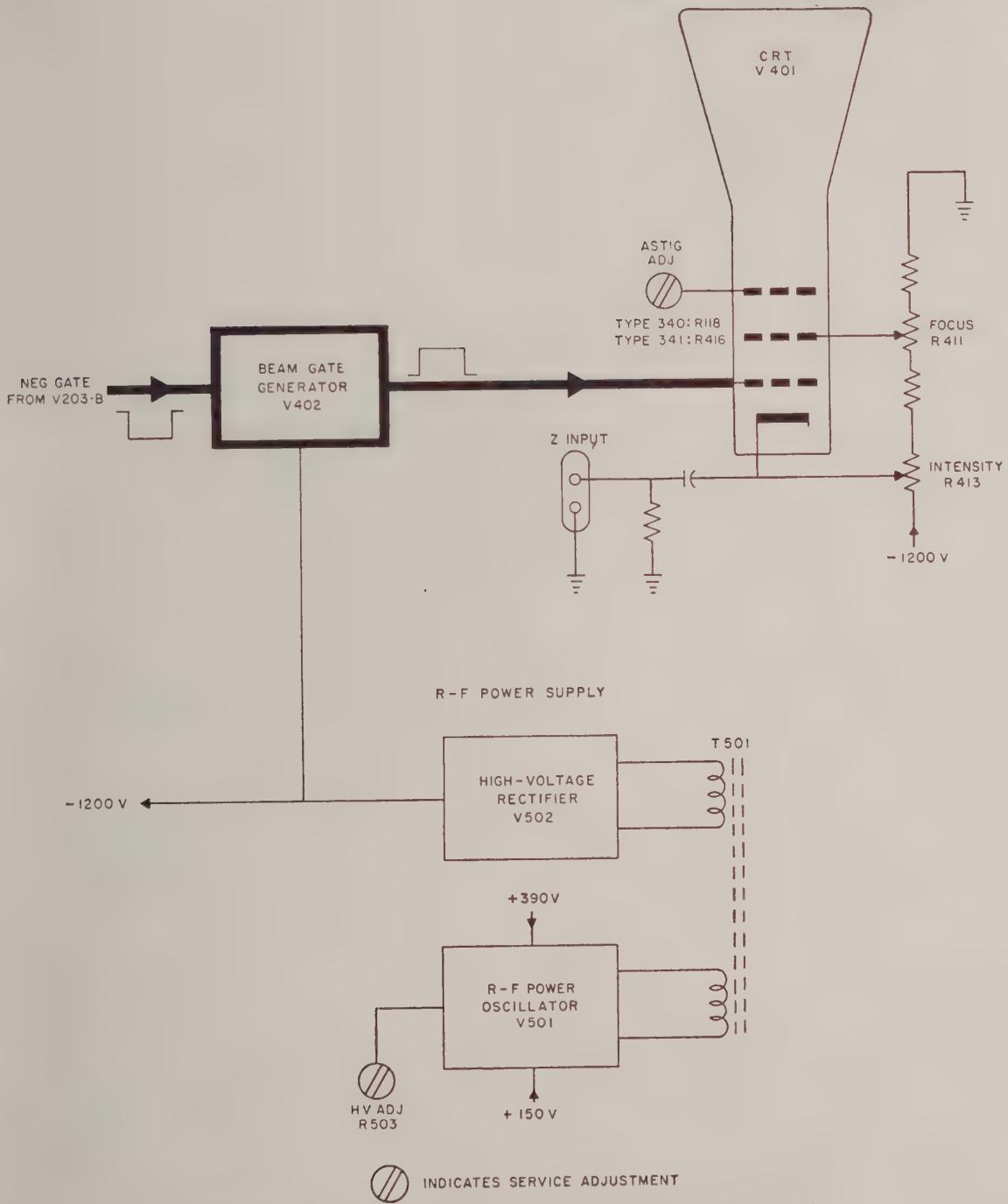


FIGURE 3-1. CATHODE-RAY TUBE AND BEAM GATE CIRCUITS, FUNCTIONAL BLOCK DIAGRAM. (TYPE 340/341)

3. Vertical Amplifier Circuitry for the Type 340 (See Figure 3-2)

a. GENERAL

To facilitate circuit analysis, the vertical-deflection circuit may be considered as consisting of:

(1) A frequency-compensated attenuator

(2) A high-gain, medium-band direct-coupled amplifier for increasing the amplitude of low level signals for suitable display on the cathode-ray tube screen.

b. Y INPUT SELECTOR SWITCH AND INPUT ATTENUATORS (See over-all schematic)

The input decade attenuators are R-C compensated to maintain frequency and phase response and to present an impedance of 2.0 megohms in shunt with 50 μμf (maximum) to the circuit under test, regardless of the attenuation selected. The Y INPUT SELECTOR switch (S101) selects the desired attenuation of the input signal in steps of approximately 0.1 V, 1.0 V, 10 V, and 100 V full scale for both A-C and D-C inputs. The OFF position of this switch removes the input signal from the attenuator and grounds the grid (pin 2), of the input d-c amplifier (V101-A.)

Provision is made for applying a balanced signal to Y INPUT when the Y INPUT SELECTOR switch is set to 0.1 (D-C) position. For details on use of this feature, refer to the instructions contained in Section 2, paragraph 7c.

c. D-C AMPLIFIER OPERATION

The vertical deflection d-c amplifiers comprise V101 through V103, inclusive. The d-c balanced circuit arrangement provides good deflection amplifier stability. The input d-c amplifier (V101) (which on balanced inputs acts effectively as a differential amplifier) precedes the continuously variable (Y) AMPLITUDE control (R114). R115, in series with this control, prevents the operator from cutting the gain all the way to zero. Thus, any signal large enough to saturate the input stage will cause greater than full-screen deflection and can be observed only after the attenuator control (Y SELECTOR) is set at a higher voltage position or if the amplitude of the applied signal is reduced. This feature prevents internally generated distortion. The nor-

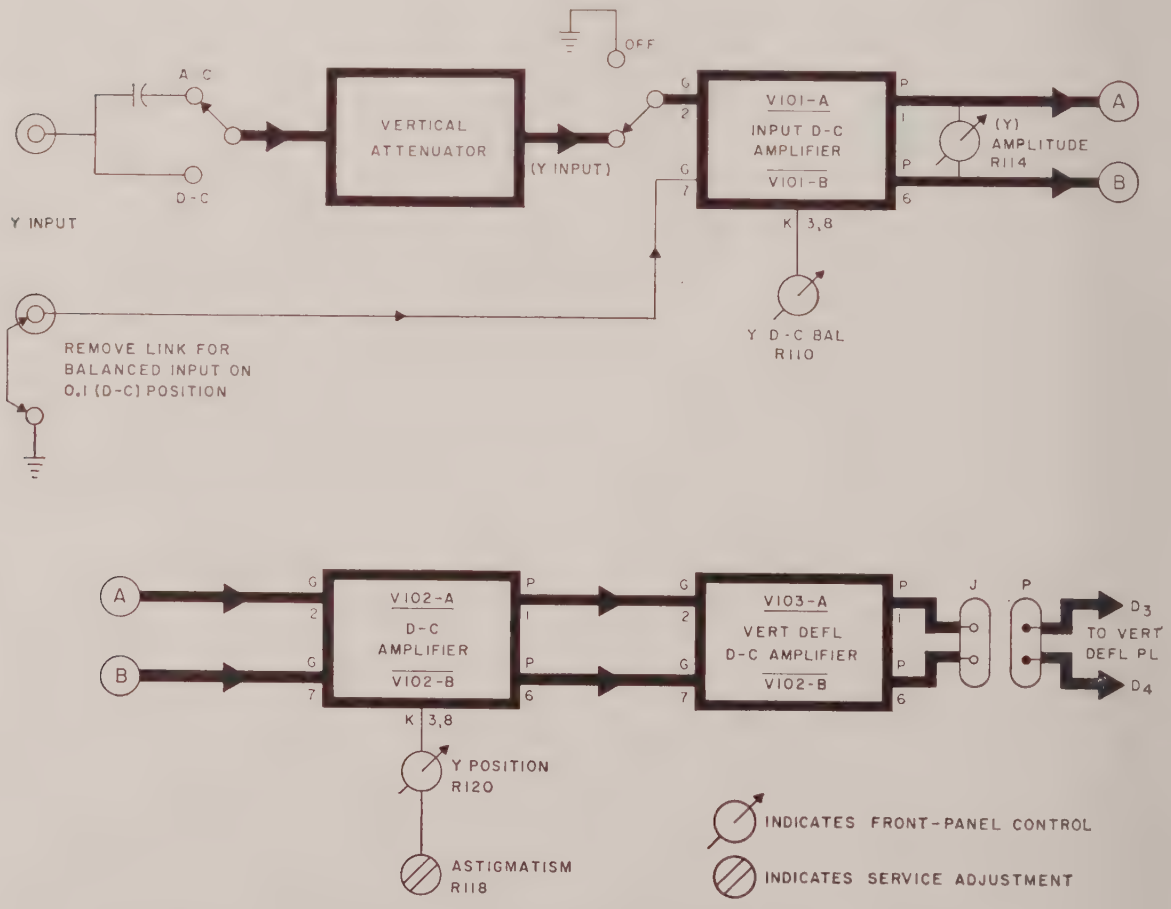


FIGURE 3-2. VERTICAL AMPLIFIER, FUNCTIONAL BLOCK DIAGRAM (TYPE 340)

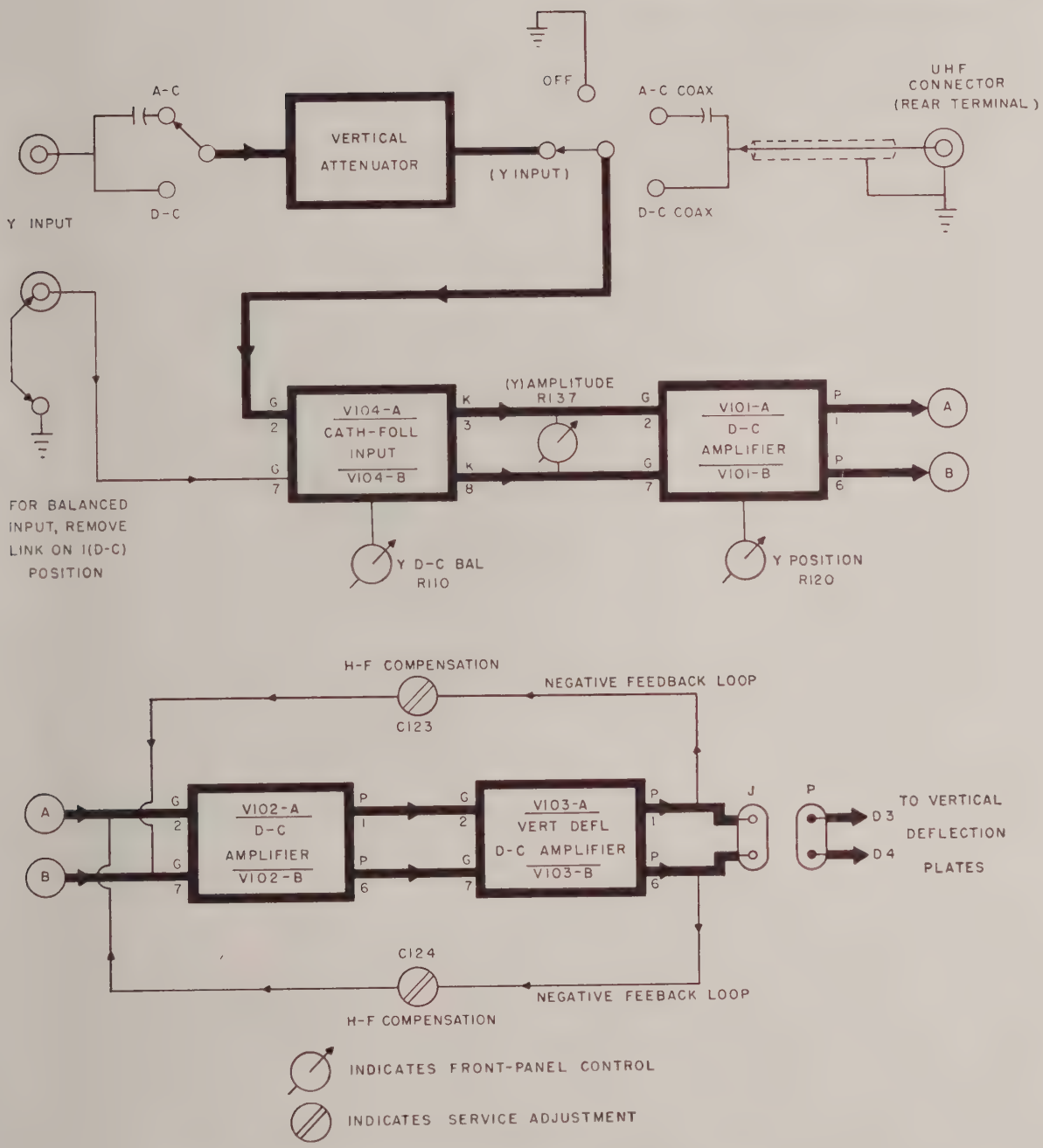


FIGURE 3-3. VERTICAL AMPLIFIER FUNCTIONAL BLOCK DIAGRAM (TYPE 341)

mally grounded grid (pin 7) of V101-B is brought out to the front-panel jack (J102) so that balanced input operation may be obtained simply by removing the ground link between J102 and J103 (front-panel terminals). The resistors (R107 and R108) in series with the grids of V101 serve to protect the input circuit from damage due to excessive input voltage.

A variable capacitor (C119) is provided which is adjusted to minimize capacitively coupled heater voltage harmonics. R603 minimizes the fundamental power line hum component.

The Y D-C BALance adjustment (R110) equalizes the voltage at the ends of the (Y) AMPLITUDE control. When this adjustment is properly set, there will be no shifting (up and down) of the trace on moving the (Y) AMPLITUDE control from minimum to maximum with no input signal to the amplifier.

The printed wiring capacitors (shown without reference symbols on the over-all schematic) are employed to neutralize the input Miller-capacity effect.

The positioning system provided is such that even with a vertical deflection equivalent to three times full-screen diameter, any full screen portion of this vertical deflection may be centered on the screen by the Y POSITION control (R120).

d. DIRECT INPUT

Provision is made for direct input to the vertical deflection plates. Refer to paragraph 9 in Section 2, Operation, for the use of this feature.

4. Vertical Amplifier Circuitry for the 341 (See Figure 3-3)

Since the Types 340 and 341 amplifiers circuits are similar, the discussion will be limited to the differences between them: These differences are:

(1) Gain has been traded for bandwidth in the Type 341 such that the vertical amplifier has a sensitivity of 400 millivolts full scale as compared to 100 millivolts full scale required by the Type 340.

(2) An extra d-c amplifier stage has been added to increase the bandwidth from 30% down at 100 kc (Type 340) to 30% down at 600 kc for the Type 341.

(3) High-frequency compensation is provided by two frequency-compensated degenerative R-C networks connected from the plates of V103-A and V103-B, to the grids of the preceding stage (V102-B and V102-A).

(4) UHF connectors are available at the rear of the Type 341 for the application of video or other signals on coaxial lines. The UHF connectors are switched into the amplifier when Y SELECTOR is set at COAX. Signals applied to these connectors do not pass through the attenuators when this method of connection is used.

(5) Undistorted deflection for the vertical amplifier is limited to four inches.

(6) A phase shift service adjustment (C118) is provided to minimize the relative phase shift between the horizontal and vertical amplifiers. Proper adjustment is made when the amplifier sensitivities are equalized.

5. Sync Circuit for the Types 340 and 341 (See Figure 3-4)

The SYNC SELECTOR switch (S201) provides selection of the synchronizing signal; INT (signal obtained from the plate of V103-B in the vertical channel); LINE frequency; or EXTernal (signal obtained from an external source).

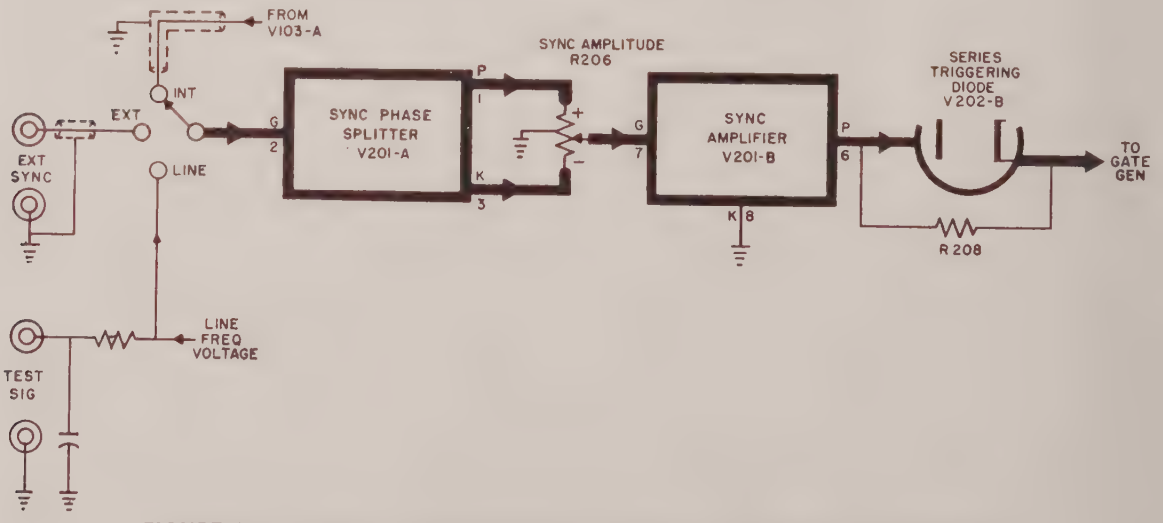


FIGURE 3-4. SYNC CIRCUIT FUNCTIONAL BLOCK DIAGRAM (TYPE 340/341)

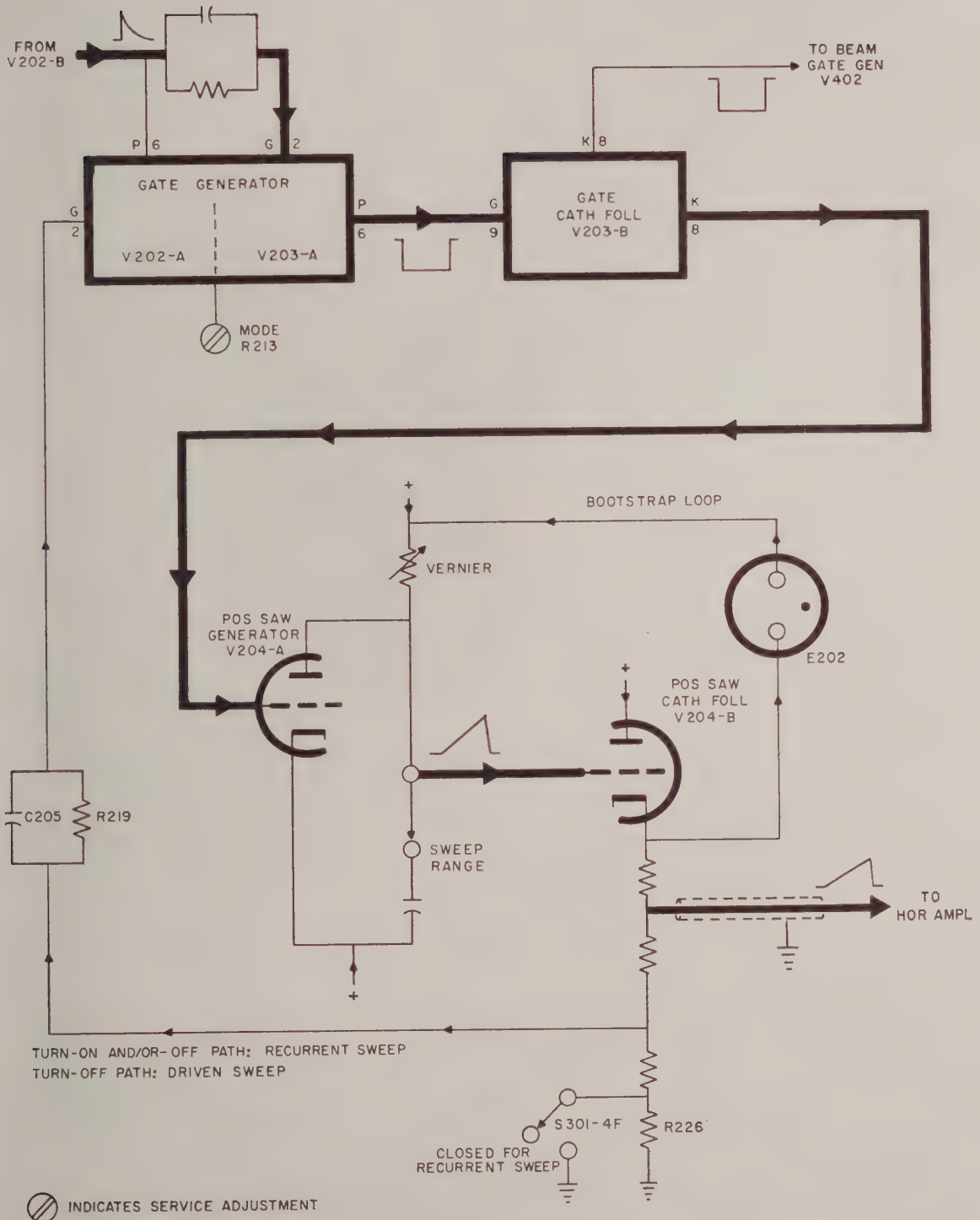


FIGURE 3-5. GATE AND SWEEP CIRCUITS, FUNCTIONAL BLOCK DIAGRAM (TYPE 340/341)

section 3
theory of operation

V201-B functions as a sync phase splitter. The SYNC AMPLITUDE control (R206) enables the operator to select the desired amplitude and polarity of the sync voltage. Following this control is the series triggering diode which is shunted by a resistor (R208) to facilitate recurrent sweep synchronization. This diode serves as a sync lockout stage during the forward sweep time as follows: When the gate generator is initiated (V202-A and V203-A), the plate of V202-A rises essentially to its plate-supply voltage. Since the cathode of V202-B is connected this point, V202-B becomes automatically nonconductive during the forward sweep time, thereby preventing the passage of unwanted sync signals.

6. Gate and Sweep Circuits for the Types 340 and 341 (See Figure 3-5)

a. DRIVEN SWEEP

(1) GATE CIRCUIT

V202-A and V203-A are connected as a bistable gate generator. The MODE service adjustment (R213) is set such that, initially, V202-A is fully conducting and V203-A is at cutoff. V203-A is initiated by a positive-going signal applied to its grid, resulting in a sudden transition of V203-A from cutoff to full conduction. Conversely, the other half of the gate generator (V202-A) is turned off. The negative gate developed at the plate of V203-A is coupled to a gate cathode-follower stage (V203-B).

(2) POSITIVE SAW GENERATOR

The negative gate output from the cathode of V203-B is coupled to the grid of the positive saw generator (V204-A), which is normally conducting and maintaining the sweep charging capacitor in a discharged state. This gate turns off V204-A and allows the voltage at its plate to rise at a rate determined by the setting of the SWEEP

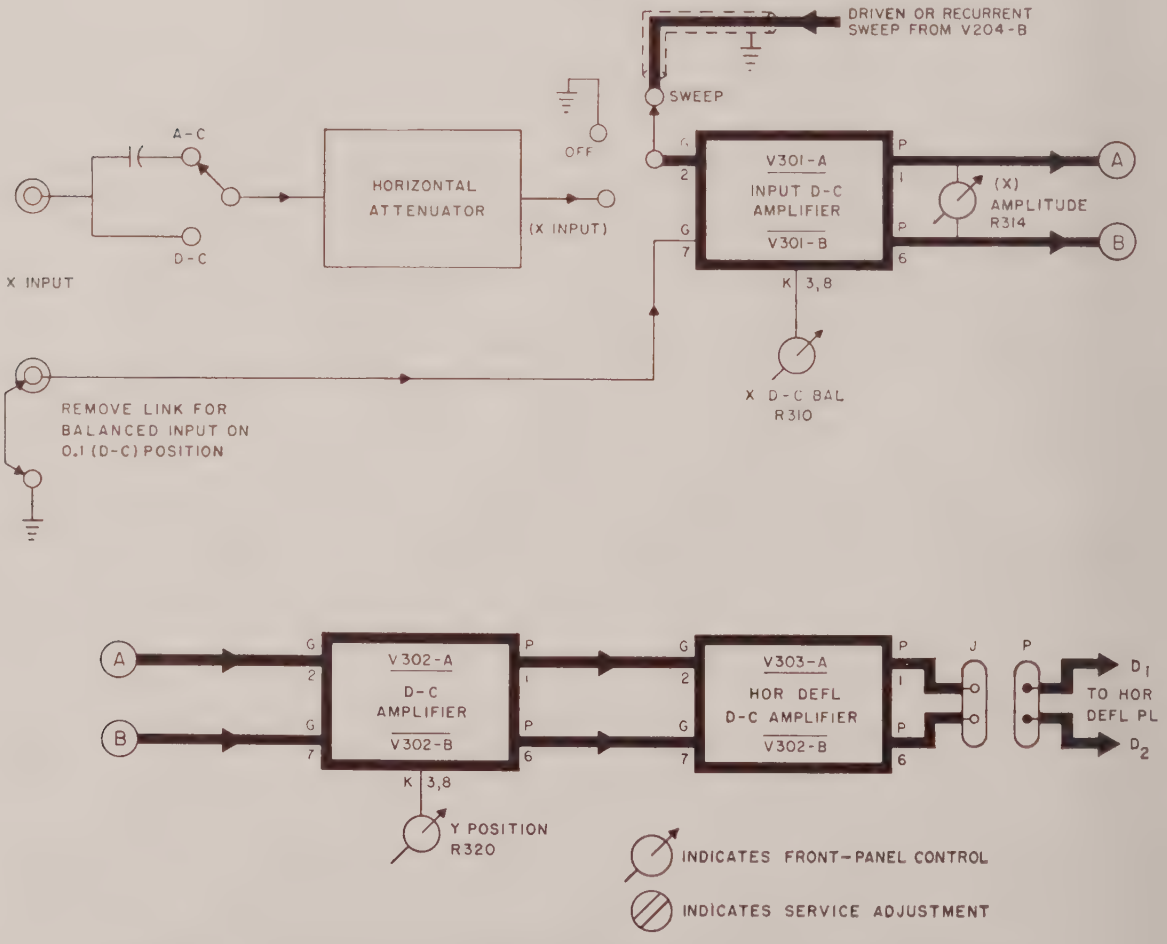


FIGURE 3-6. HORIZONTAL AMPLIFIER, FUNCTIONAL BLOCK DIAGRAM (TYPE 340)

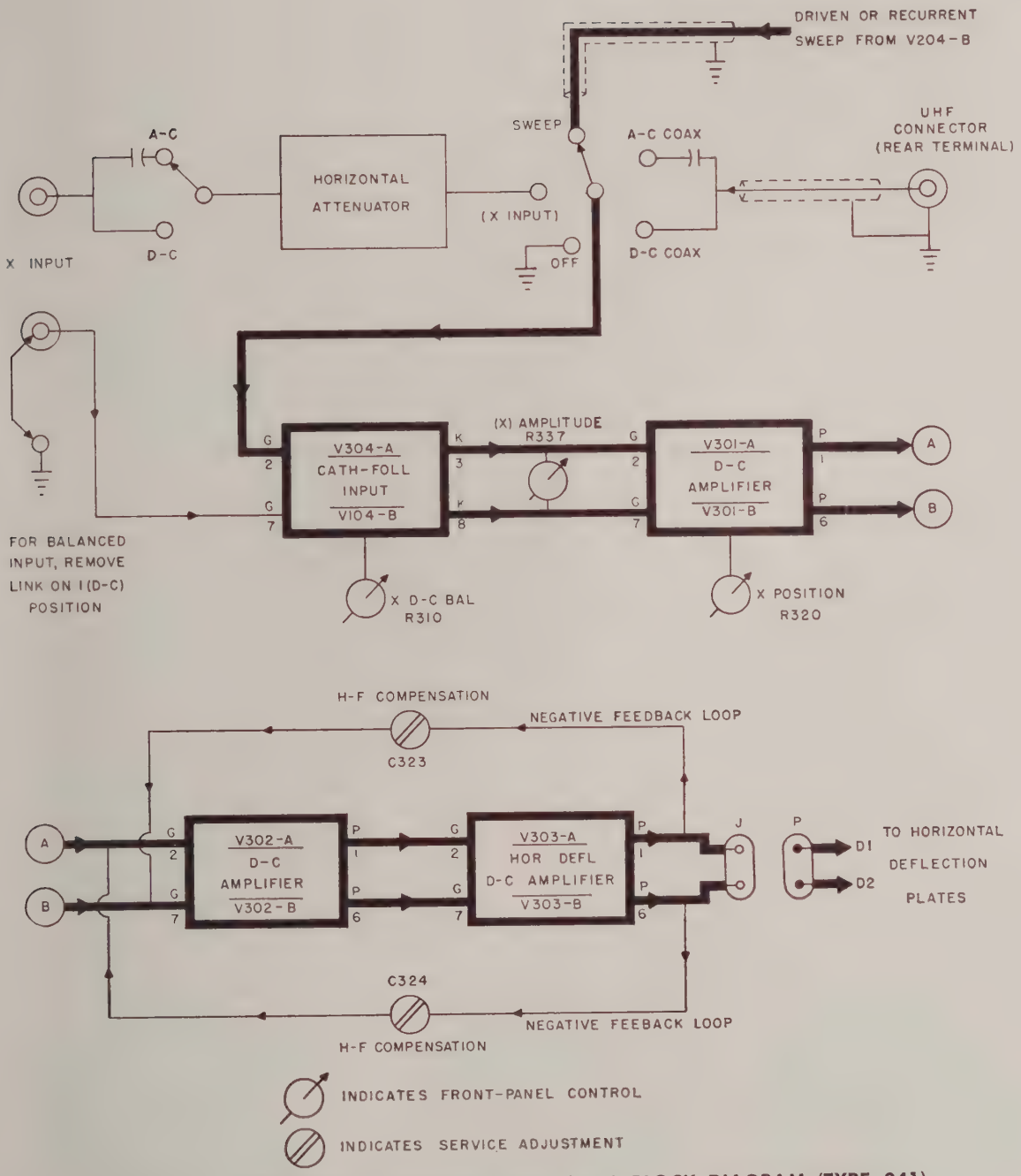


FIGURE 3-7. HORIZONTAL AMPLIFIER FUNCTIONAL BLOCK DIAGRAM (TYPE 341)

RANGE and VERNIER controls. The resultant sawtooth voltage across the charging capacitor is coupled to the positive saw cathode follower (V204-B) and thence to the horizontal amplifier by means of the X SELECTOR switch.

The voltage at the cathode of V204-B is fed back to the grid of the nonconducting gate tube (V202-A) via an R-C coupling network (R219 and C205). This restores the gate generator to its initial operating condition (when the positive saw reaches a pre-determined level) thus terminating the sweep. The beam will sweep the

screen again only upon application of another positive-going signal to the grid of V203-A.

A high degree of linearity is achieved by causing the d-c voltage of the charging source to rise at saw rate through use of a gas tube (E202) coupled to the top of the (SWEEP) VERNIER charging resistor. This essentially provides a constant-current charging source for the sweep capacitor.

b. RECURRENT SWEEP

When the X SELECTOR switch is set at RECUR SWEEP, the top of R226 in the saw-divider network is returned to ground. This action establishes a new d-c level of the feedback path to V202-A such that the saw-return trace is able to initiate this stage. Under these conditions, the gate generator (V202-A and V203-A) will essentially be free running. Subsequent development of the positive saw is similar to that described for driven sweep.

RECUR SWEEP synchronization is accomplished near the end of the forward-sweep trace; for DRIVEN SWEEP, it is achieved at the start of the forward sweep. Consequently, a phase shift of 180° will be noted when switching from DRIVEN to RECUR SWEEP or vice versa.

7. Horizontal Amplifier Circuitry for the Type 340 (See Figure 3-6)

Since identical vertical and horizontal amplifiers are employed in the Type 340, the previously discussed theory for the vertical amplifier is equally applicable, except for the X SELECTOR switch (S301).

By means of the X SELECTOR switch, provision is made for the selection of internal or external signals for horizontal deflection. The internal signal is obtained from the driven or recurrent sweep circuits described earlier. External signals may be applied to the X INPUT terminals.

The sensitivity of the horizontal channel is 128 millivolts full scale while that of the vertical channel is 100 millivolts full scale. This difference in sensitivity results from the different deflection factors of the horizontal and vertical deflection plates of the cathode-ray tube. The amplifiers themselves are identical.

When the X SELECTOR switch is set for external signals, the sweep circuit is not disabled unless the SYNC AMPLITUDE control is set at "0." Thus, it is possible to trigger the sweep, while viewing external signals, to superimpose the brightening gate on the trace. For use of this feature, see paragraph 8d, in Section 2, Operation.

8. Horizontal Amplifier Circuitry for the Type 341 (See Figure 3-7)

The Type 341 also employs identical vertical and horizontal amplifiers, hence, reference to the vertical circuitry for the 341 is equally valid. In addition, circuit description of the X SELECTOR switch (See paragraph 7 of this section) is also applicable. See Table 1-1 for amplifier sensitivity.

9. POWER SUPPLY (See Over-all schematic)

A self-regulating power transformer (T601) employing a magnetic shunt and a 60-cycle resonant secondary winding is used to minimize the effect of line-voltage variation. Once resonance is attained, it is used as the basis of maintaining the output voltage of the transformer constant.

V601 is connected in a conventional full-wave rectifier circuit. The rectified output is filtered by a capacitor-input type filter (C601-C, L601 and C601-B).

Warning

POTENTIALS AS HIGH AS 1500 VOLTS EXIST IN THIS INSTRUMENT. OBSERVE THE FOLLOWING PRECAUTIONS WHEN NECESSARY TO ENERGIZE THE EQUIPMENT WITH THE CABINET REMOVED.

(1) Never work alone.
(2) Make sure the chassis is properly grounded.
(3) Disconnect power before changing any tubes.
(4) Before touching any component, short the terminals to remove any possible charge that may remain after removing the power.

1. General

The first step in correcting any trouble or failure that may occur is to isolate the section of the circuit causing the trouble. Such isolation can be accomplished by considering the circuit as composed of the basic sections shown in the over-all block diagram, Figure 1-2.

The next step after isolating the trouble to a particular section is to determine the specific tube circuit involved. A replacement tube should be tried before attempting any other test. *Indiscriminate tube changing must be avoided. If after tube replacement, the trouble persists, replace the original tube in its socket.* NOTE: Replacement of certain tubes will require resetting on one or more service adjustments. Consult Table 4-4 for special instructions. If trouble persists, voltage and resistance measurements should be made.

2. Maintenance Reference Data

a. OVER-ALL SCHEMATICS

Over-all schematics of the circuits will be found at the back of this section and should be consulted while trouble shooting. Lists of the component electrical parts, including descriptions, are also provided.

b. TROUBLE SHOOTING CHART

As an aid in servicing, Trouble Shooting Chart, Table 4-1, indicates symptoms, probable causes of trouble and curative measures.

c. VOLTAGE AND RESISTANCE MEASUREMENTS

Tables 4-2 and 4-3 lists voltages and resistances from tube pins to ground, except as otherwise noted, for the Types 340 and 341 respectively. Voltage measurements shown were taken using a test meter having an internal resistance of 20K ohms/volt except as otherwise noted. Good judgment is often required to determine if a particular deviation from the value shown is indicative of trouble.

d. TUBE LOCATIONS

Tubes may be located by reference to Figures 4-2 through 4-5, 4-7, 4-9, and 4-10.

3. Gaining Access to the Chassis

To remove the instrument from its cabinet, remove the two screws at the back of the cabinet

(A) Correct Waveform (B) Overcompensated (D) Undercompensated

FIGURE 4-1. WAVEFORMS ENCOUNTERED IN ADJUSTING ATTENUATOR COMPENSATION CAPACITORS

and slide the instrument forward, taking care that the line cord is free to slide through the hole provided. For the -R models, in addition to the rear screws, remove the four outermost front-panel screws located at the top and bottom center, and left and right center. Slide the instrument forward while observing the previously mentioned precaution.

4. Service Adjustments

a. GENERAL

Service adjustments may be identified by reference to the call-out illustrations, Figures 4-2 through 4-5, 4-7 and 4-8. Do not touch any service adjustments unless tests clearly indicate the need to do so. Such adjustments should not be attempted without complete understanding of the proper procedure.

Caution

To avoid screen burns, keep intensity low.

b. TEST EQUIPMENT REQUIRED

Description	*Range or Characteristics*
Volt-ohmmeter	20K ohms/volt Test Meter or Electronic Voltmeter
Square-wave Generator	1KC to 100KC

PRECAUTION

DO NOT SET ANY SERVICE ADJUSTMENT WITHOUT FOLLOWING SPECIFIC INSTRUCTIONS AND SEQUENCE GIVEN BELOW. SOME ADJUSTMENTS ARE INTERDEPENDENT.

c. POWER SUPPLY CIRCUIT

(1) HV ADJ for Type 340 (R503—see Figure 4-3)

(2) HV ADJ for Type 341 (R503—see Figure 4-7)

(a) TEST PROCEDURE FOR (1) AND (2).—Check that the high voltage measures –1200 volts (nominal). If not, adjust to –1200 volts by means of R503.

d. CATHODE-RAY TUBE CIRCUIT

(1)ASTIG ADJ for Type 340 (R118—see Figure 4-3)

(2) ASTIG ADJ for Type 341 (R416—see Figure 4-7)

(a) TEST PROCEDURE FOR (1) AND (2).—Check by patching the TEST SIG to Y INPUT. Adjust the appropriate front-panel controls to obtain several cycles on the screen. Adjust the FOCUS control for the sharpest trace, which should now be of uniform width throughout its length. If not, set ASTIG ADJ to obtain this condition. It will probably be necessary to readjust the FOCUS control simultaneously with the ASTIG ADJ to maintain best focus. Once properly adjusted, the ASTIG ADJ should require no further attention under normal conditions.

e. SERVICE ADJUSTMENTS FOR THE VERTICAL AMPLIFIER

(1) HUM BAL and Hum Harmonic Trimmer for Type 340 (R603 and C119—see Figure 4-3)

(2) HUM BAL for Type 341 (R603—see Figure 4-7)

(a) TEST PROCEDURE FOR (1) AND (2)—Check by setting (Y) AMPLITUDE fully CW and Y SELECTOR fully CCW. Shield the Y INPUT terminals and adjust the appropriate front-panel controls for a trace. The power-line frequency ripple should not exceed 0.05 inch. If it does, adjust the HUM BAL potentiometer and/or Hum Harmonic Trimmer to give minimum residual ripple.

(3) Y SELECTOR Compensation Capacitors for Type 340 (C105 through C107—see Figure 4-4)

(4) Y SELECTOR Compensation capacitors for Type 341 (C105 and C106—see Figure 4-7)

(b) TEST PROCEDURE FOR (3) AND (4)—These capacitors may be checked by applying a 1 kc square wave signal to Y INPUT and adjusting, the appropriate trimmer if necessary, to pass the square wave with minimum distortion. Figure 4-1, "A" represents proper adjustment while "B" and "C" represent conditions of over and under-compensation, respectively.

(5) High-frequency Compensation for Type 341 (C123 and C124—see Figure 4-7)—Check by applying a 100 kc square wave signal to Y INPUT and note whether the amplifier passes this

signal with minimum distortion. If not, adjust C123 and C124 to obtain a flat-top square wave.

f. SERVICE ADJUSTMENTS FOR THE HORIZONTAL AMPLIFIER

(1) X SELECTOR Compensation Capacitors for Type 340 (C305 thru C307—see Figure 4-5)

(2) HUM BAL and Hum Harmonic Trimmer for Type 340 (R603 and C319—see Figure 4-2)

(3) X SELECTOR Compensation Capacitors for Type 341 (C305 and C306—see Figure 4-8)

(4) High-frequency Compensation for Type 341 (C323 and C324—see Figure 4-8)

(a) TEST PROCEDURE FOR (1), (2), (3) AND (4).—The checking and adjustment procedure for the horizontal amplifier is identical to that described for the vertical amplifier. Hence, refer to the appropriate paragraph under 4e for the proper checking procedure.

g. PHASE SHIFT ADJUSTMENT (TYPE 341)

(1) Phase Shift Trimmer (C118—see Figure 4-7).—Before checking, make sure that the vertical and horizontal amplifier h-f compensation trimmers are checked out.

To obtain an accurate pattern from which phase difference can be determined between the vertical and horizontal amplifiers, proceed as follows:

Step 1. Apply a 100 kc square wave signal to Y INPUT and set X SELECTOR at OFF.

Step 2. Adjust the Y SELECTOR and AMPLITUDE controls for three inches of vertical deflection; be extremely careful not to disturb the (Y) AMPLITUDE control setting for the remainder of the test.

Step 3. Center the trace with Y POSITION control.

Step 4. Set Y SELECTOR at OFF, SYNC AMPLITUDE at "0," and apply the same 100 kc square wave signal to X INPUT. (Do not remove signal from Y INPUT.)

Step 5. Adjust the X SELECTOR and AMPLITUDE controls to give a horizontal deflection equal to that to which the vertical amplifier is adjusted (three inches); be extremely careful not to disturb the (X) AMPLITUDE control setting throughout the remainder of the test.

Step 6. Center the trace with X POSITION control.

Step 7. Set Y SELECTOR to correspond with X SELECTOR setting.

Step 8. With the vertical and horizontal amplifiers gains equalized, the resulting line should be slanted 45° (towards the right) with the bright spots at either end. If not, adjust C118 to obtain this condition.

h. SWEEP CIRCUIT

(1) MODE for Type 340 (R213—see Figure 4-2)

(2) MODE for Type 341 (R213—see Figure 4-8)

(a) TEST PROCEDURE FOR (1) AND (2).—Improper adjustment of R213 will show up either as operation of the sweep in the DRIVEN mode with the SYNC AMPLITUDE control at "0," or as failure of the sweep to operate in the RECURrent mode.

To adjust, set X SELECTOR at DRIVEN SWEEP and SYNC AMPLITUDE at "0." Adjust R213 just below the threshold of recurrent sweep. Set SYNC SELECTOR at LINE. Check that a slight rotation of the SYNC AMPLITUDE control in either direction causes the sweep to operate.

5. Replacement of Cathode-ray Tube

Caution

The cathode-ray tube should be handled with great care to prevent breakage, which might result in serious personal injury from flying glass. Do not employ force at any time. As an added precaution, it is advisable to wear safety goggles and gloves.

The following procedure is suggested for replacing the cathode-ray tube.

Step 1. Turn off power; remove cabinet or dust cover.

Step 2. Remove bezel held by four screws at front panel.

Step 3. Remove the cathode-ray tube socket.

Step 4. Loosen the cathode-ray tube clamp.

Step 5. Remove tube through front-panel opening.

Step 6. Install new tube through front-panel opening, and replace the bezel.

Step 7. Tighten the cathode-ray tube clamp.

Step 8. Replace the tube socket.

Step 9. Apply power and check the sweep; if not horizontal, loosen the cathode-ray tube clamp and rotate tube as required. CAUTION: HIGH VOLTAGE EXISTS ON CRT SOCKET. USE EXTREME CAUTION. Tighten clamp, being careful not to rotate tube in so doing.

6. Du Mont "Oscillographer"

The Du Mont "Oscillographer," a periodical, is published by the Allen B. Du Mont Laboratories, Inc., and is sent free of charge to engineers, research workers, and those engaged in the use and application of cathode-ray equipment. When sending in subscriptions or when sending notification of change of address, please supply the following information: name, company name, company address, type of business, and title of individual.

7. Du Mont Warranty

All instruments produced by the Instrument Division of Allen B. Du Mont Laboratories, Inc., are sold under the Du Mont Warranty. For the provisions of this warranty, see the Warranty and Service Notice on the inside cover.

8. Service

The Instrument Division maintains complete facilities for servicing Du Mont equipment. For details of the Instrument Service policies, see the Warranty and Service Notice on the inside back cover.

TABLE 4-1
TROUBLE SHOOTING CHART

I. POWER SUPPLY AND CRT CIRCUITRY

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
1-1 Pilot indicator fails to light	1-1a Line cord not plugged into a live outlet	1-1a Trace line failure
	1-1b Pilot indicator lamp open	1-1b Replace
	1-1c Blown primary fuse (F604)	1-1c Check and replace
	1-1d Blown secondary heater fuse (F603)	1-1d Check and replace
	1-1e POWER switch defective	1-1e Place an ohmmeter across prongs at line cord and check continuity in the ON position; resistance should measure approximately 5 ohms
1-2 Line fuse blows instantly when POWER switch is turned on	1-2a Short in primary circuit	1-2a See 1-1e for checking procedure
1-3 B+ fuse (F601) blows after approximately one minute when POWER switch is turned ON	1-3a Defective low-voltage supply	**Warning** PERSONAL CONTACT WITH THE +390-VOLT SUPPLY MAY PROVE *FATAL* 1-3a (1) Make resistance check as follows:

Supply	Resistance to Ground	
	Type 340	Type 341
+390V	300K	70K
+150V	50K	60K

(2) Check that C601-A, C601-B, and C601-C are not shorted to ground

(3) Check voltage and resistance of V601 and V602 as per Table 4-2 or 4-3. Refer to the over-all schematic for checking other components

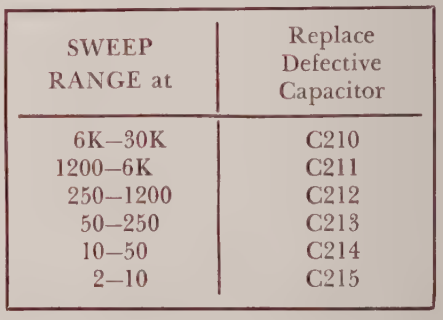
TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

	SYMPTOM		PROBABLE CAUSE		CURATIVE MEASURES
1-4	No spot on cathode-ray tube screen	1-4a	Spot might be depositioned due to a defective amplifier stage	1-4a	To check, see 2-1a and 3-1b
		1-4b	Spot might be depositioned due to a disconnection between the amplifier and the deflection plates	1-4b	Check that the X DIR and Y DIR deflection plugs are properly connected at rear of cabinet
		1-4c	Defective negative high-voltage supply (V501 and V502)	1-4c	Tube replacement should be tried first. Measure voltage and resistance of V501 and V502 per Tables 4-2 and 4-3
		1-4d	Defective low-voltage supply	1-4d	The low voltages are required for application to the r-f power oscillator (V501). See 1-2b
		1-4e	Defective cathode-ray tube	1-4e	Check to see if tube is lit or feel for warmth. Caution—HV
		1-4f	CRT not properly seated in its socket	1-4f	Check to see that CRT is properly seated in socket
1-5	Output voltages "very low"	1-5a	C602 may be defective	1-5a	C602 has been selected to resonate with T601. If replacement is necessary, replace it with one having the same color dot stamped on the end of laminations (SOLA)
1-6	Output voltage varies. Line voltage within tolerance	1-6a	Line frequency varies	1-6a	T601 is intended for use with 60-cycle power line mains. Changes in the frequency of the supply voltage will be directly reflected in the output voltage. A change of about 1.8% in output voltage will occur for every 1% change in input frequency, and in the same direction as the frequency change
1-7	Excessive spot size variation as it is positioned over the screen (non-uniform focus)	1-7a	ASTIG ADJ improperly set	1-7a	Refer to paragraph entitled "Service Adjustments for the Cathode-ray Tube" in this Section
1-8	Uniformity of trace brightness varies with INTENSITY settings	1-8a	Stray pick-up at Z INPUT terminal (idle connector or cable is coupled to terminals)	1-8a	Short out Z INPUT

TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
	1-8b Also, r-f on trace will give this effect (intensity markers). Hum in supply	1-8b Check filter capacitors C501 and C502; replace if necessary
1-9 R-F pick-up	1-9a Loose r-f shield or cover on the r-f supply	1-9a Check and tighten if necessary
1-10 Bright spot at left side of screen	1-10a Defective beam gate circuit (V402)	1-10a Tube replacement should be tried first. V & R measurements of V402 should be taken with respect to cathode (pins 3 or 8). Refer to the over-all schematic for checking other components
	2. HORIZONTAL DEFLECTION CIRCUITRY (X-AXIS)	
2-1 No sweep, X SELECTOR at RECUR SWEEP	2-1a Spot might be depositioned due to a defective horizontal amplifier stage	2-1a To check, short together the plates of V303. If spot returns to center, one or more horizontal amplifier stages are defective. See 2-1b for tracking down this trouble
	2-1b Defective X amplifier	2-1b (1) To check, patch the TEST SIG to X INPUT, set X SELECTOR for minimum attenuation and (X) AMPLITUDE fully CCW (2) If trace appears, X amplifier is O.K. (3) If trace does not appear, try the one-at-a-time method of replacing the following tubes: V301 through V303; V304 (Type 341 only) NOTE: The original tube should be restored to its socket if not found to be defective (4) If tube replacement fails to clear up the trouble, make a voltage and resistance check. When checking V & R, use Table 4-2 for Type 340 and Table 4-3 for Type 341
2-2 No sweep; X SELECTOR at RECUR SWEEP. Horizontal deflection circuit checks okay.	2-2a MODE adjustment (R213) improperly set	2-2a Refer to the paragraph entitled "Service Adjustments for the Sync and Sweep Circuits" in this Section for the proper checking procedure

TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
	2-2b Defective gate circuitry (V202-A and 203)	2-2b Check tubes; take voltage and resistance measurements per Table 4-2 for Type 340, Table 4-3 for Type 341
	2-2c Defective sweep circuitry (V204)	2-2c See 2-2b
	2-2d Junction of R226 and R227 not tied to ground in RECUR SWEEP position	2-2d Check X SELECTOR switch; section S301-4F, which shunts R226 to ground in RECUR position
	2-2e Recurrent sweep gate turn-on path defective	2-2e Check continuity of path from junction of R227 and R228 to the grid (pin 2) of V202-A
	2-2f No continuity from sweep circuit to horizontal amplifier	2-2f Check continuity from junction of R221 and R222 to grid (pin 2) of V301-A. This checks the continuity of the shielded cable between the sweep and horizontal circuits; also checks X SELECTOR switch, sections S301-3R and S301-3F
2-3 No sweep in any one range of the SWEEP RANGE switch. (X SELECTOR at RECUR SWEEP)	2-3a Short in the associate sweep range capacitor. Note: (Open capacitor will cause a low frequency range to shift to highest range i.e. 6K-30K)	2-3a 
	2-3b Defective SWEEP RANGE switch	2-3b Repair or replace
2-4 (SWEEP) VERNIER has little or no effect on sweep frequency	2-4a Shorted potentiometer (R223)	2-4a Check and replace
2-5 Non-linear sweep	2-5a Defective saw regulator (E202)	2-5a Replace

SWEEP RANGE at	Replace Defective Capacitor
6K—30K	C210
1200—6K	C211
250—1200	C212
50—250	C213
10—50	C214
2—10	C215

TABLE 4-1

TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
2-6 Loss of sync	2-6a Sync phase splitter (V201-A) and amplifier (V201-B) defective	2-6a Check and replace. Check tube pin voltages and resistances per V & R Table
	2-6b SYNC SELECTOR switch is not in the proper position for the desired mode of operation	2-6b (1) Set SYNC SELECTOR switch at INTernal when X SELECTOR switch is set at either DRIVEN or RECURrent SWEEP (2) External sync signals may be employed if SYNC SELECTOR is set at EXTernal (3) If line frequency excitation is employed, SYNC SELECTOR should be set at LINE (4) If X SELECTOR is set for external signals (A-C, D-C or COAX), SYNC SELECTOR should be set at EXTernal. (SYNC AMPLITUDE should be set at "0")
	2-6c Shunting resistor (R208) across V202-B open (RECUR SWEEP only)	2-6c Check R208 and replace
2-7 Undesired intensity modulation of trace noted when X SELECTor is set for external signals	2-7a SYNC AMPLITUDE not set to "0"	2-7a Set to "0." This "Symptom" can be a "feature" if desired; see paragraph entitled "Gated-beam Operation," in Section 2, Operation
2-8 No sweep; X SELECTOR set at DRIVEN SWEEP	2-8a Defective X SELECTOR switch	2-8a To check, switch X SELECTOR to RECUR SWEEP (1) If sweep fails to appear, see 2-1 and 2-2 (2) If sweep appears, reset X SELECTOR back to DRIVEN SWEEP and see 2-8b
	2-8b Inadequate amplitude of sync initiation signal	2-8b Adjust SYNC AMPLITUDE control for the proper phase and amplitude of the synchronization signal. In addition, refer to Table 1-1, Technical Summary Sheet, for sync sensitivities

TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
2-9 Approximately 1/2 of sweep trace is missing	2-9a One of the horizontal amplifier stages is defective	2-9a See 2-1b
2-10 DRIVEN SWEEP does not cutoff when SYNC AMPLITUDE is set at "0"	2-10a MODE service adjustment (R213) improperly set	2-10a See 2-2a
2-11 DRIVEN or RECUR SWEEP O.K. Cannot position trace on screen when X SELECTOR is set for external signals	2-11a X D-C BAL control is set either fully CW or CCW and (X) AMPLITUDE is set fully CW	2-11a Set (X) AMPLITUDE fully CCW. Trace may now be positioned on screen regardless of X D-C BAL control setting
2-12 X SELECTOR is OFF. CRT spot shifts (left and right) with changes in setting of (X) AMPLITUDE control	2-12a When using horizontal amplifier for application of external signals, X D-C BAL control must be adjusted first	2-12a See "X D-C BAL Adjustment" in Section 2, Operation NOTE: For DRIVEN or RECUR SWEEP operation, X D-C BAL may be employed as a sweep position control, hence, the necessity for readjustment arises when using external signals
2-13 X SELECTOR set for external signals. No trace when set for A-C; O.K. for D-C	2-13a Input coupling capacitor open (C301) 2-13b Defective X SELECTOR switch	2-13a Replace 2-3b Check switch section S301-2R
2-14 X SELECTOR set at COAX for application of external signals (Type 341 only). No trace when set for A-C; O.K. for D-C	2-14a Input coupling capacitor open (C325) 2-14b Defective X SELECTOR switch	2-14a Replace 2-14b Check switch section S301-1R
2-15 Same as 2-14 except no trace for either A-C or D-C input	2-15a Defective shielded cable and/or connection	2-15a Check cable continuity (see over-all schematic)

TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
2-16 A 1KC square wave is distorted at any one range of the X SELECTOR switch (A-C or D-C)	2-16a Improper adjustment in the associate X SELECTOR compensation capacitor	2-16a See "Service Adjustments" paragraph in section 4 for the proper checking procedure
2-17 A 100KC square wave applied to X INPUT is distorted (Type 341 only)	2-17a High-frequency compensation capacitors improperly adjusted (C323 and C324)	2-17a See "Service Adjustments" paragraph in section 4 for the proper checking procedure

X SELECTOR at (A-C or D-C)	Capacitor Requiring Adjustment	
	Type 340	Type 341
0.1	None	Not Applicable
1	C305	None
10	C306	C305
100	C307	C306

3. VERTICAL DEFLECTION CIRCUITRY (Y-AXIS)

3-1 An appropriate signal is applied to Y INPUT. No vertical displacement of the trace results	3-1a Trace might be depositioned due to setting of Y D-C BAL fully CW or CCW and (Y) AMPLITUDE fully CW	3-1a To check, set (Y) AMPLITUDE fully CCW. Trace can now be positioned on screen irrespective of Y D-C BAL setting
	3-1b Trace might be dispositioned due to a defective amplifier stage	3-1b To check, short together the plates of V103. If spot returns to center one or more vertical amplifier stages are defective. See 3-1c for tracking down this trouble
	3-1c Defective vertical amplifier	3-1c (1) Try the one-at-a-time method of replacing the following tubes: V101 through V103; V104 (Type 341 only) NOTE: The original tube should be restored to its socket if not found to be defective (2) If tube replacement fails to clear up the trouble, make a voltage and resistance check. When checking V & R, use Table 4-2 for Type 340 and Table 4-3 for Type 341

TABLE 4-1
TROUBLE SHOOTING CHART (Continued)

	SYMPTOM		PROBABLE CAUSE		CURATIVE MEASURES
3-2	Ripple on trace	3-2a	HUM BAL service adjustment(s) improperly set	3-2a	Refer to the appropriate paragraph under "Service Adjustments" in Section IV for the proper checking procedure
3-3	No vertical signal when Y SELECTOR switch is set at A-C; signal is present when switch is set to D-C	3-3a	Open input coupling capacitor (C101)	3-3a	Replace
		3-3b	Defective Y SELECTOR switch	3-3b	Check switch section S101-2R
3-4	Y SELECTOR set at COAX, (Type 341 only) no signal at A-C; O.K. at D-C	3-4a	Open input coupling capacitor (C125)	3-4a	Replace
		3-4b	Defective Y SELECTOR switch	3-4b	Check switch section S101-1R
3-5	Same at 3-4 except no trace for either A-C or D-C input	3-5a	Defective shielded cable and/or connection	3-5	Check cable continuity (see over-all schematic)
3-6	Intermittent or jumpy trace—with or without Y INPUT signal	3-6a	Defective tube-to-socket contact or corrosion of tube pins	3-6a	Check and clean **WARNING** PERSONAL CONTACT WITH THE +390-VOLT SUPPLY MAY PROVE *FATAL*
		3-6b	High resistant PW (printed wiring) connections to PW pins	3-6b	Check by exerting gentle pressure on various parts of the PW board to pin point the intermittency; when found, resolder pin(s) by hand
		3-6c	High resistant PW connections between components and PW pins	3-6c	Refer to preceding comment
		3-6d	Broken resistor(s) or PW connections	3-6d	Check for continuity while pressing or tapping component under suspicion

TABLE 4-1

TROUBLE SHOOTING CHART (Continued)

SYMPTOM	PROBABLE CAUSE	CURATIVE MEASURES
3-7 Y SELECTOR at OFF, CRT trace shifts (up and down) with changes in setting of (Y) AMPLITUDE control.	3-7a Y D-C BAL (R110) improperly adjusted	3-7a See "Y D-C BAL Adjustment" in Section 2, Operation
3-8 Excessive relative phase shift between vertical and horizontal amplifiers (Type 341 only)	3-8a Phase shift service adjustment improperly set (C118)	3-8a See the appropriate paragraph under "Service Adjustments" in Section 4 for the proper checking procedure
3-9 A 1KC square wave is distorted at any one range of the Y SELECTOR switch (A-C or D-C)	3-9a Improper adjustment in the associate Y SELECTOR compensation capacitor	3-9a See "Service Adjustments" paragraph in Section 4 for the proper checking procedure
3-10 A 100KC square wave applied to Y INPUT is distorted (Type 341 only)	3-10a High-frequency compensation capacitors improperly adjusted (C123 and C124)	3-10a See "Service Adjustments" paragraph in Section 4 for the proper checking procedure

Y SELECTOR at (A-C or D-C)	Capacitor Requiring Adjustment	
	Type 340	Type 341
0.1	None	Not Applicable
1	C105	None
10	C106	C105
100	C107	C106

TABLE 4-2
VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 340

Preset front-panel controls according to the following chart:

CONTROL	SETTING	CONTROL	SETTING	CONTROL	SETTING
INTENSITY	For normal trace	(X) AMPLITUDE	Fully CW	SWEEP RANGE	Any position
FOCUS	Focused trace	Y SELECTOR	OFF	VERNIER	Any position
X POSITION	To center trace	(Y) AMPLITUDE	Fully CW	X D-C BAL	For balanced condition
Y POSITION	To center trace	SYNC AMPLITUDE	0	Y D-C BAL	
X SELECTOR	OFF				

WARNING

PERSONAL CONTACT WITH THE +390-VOLT SUPPLY MAY PROVE *FATAL*

TYPE 340 VERTICAL AND HORIZONTAL AMPLIFIERS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V101 or V301	12AU7 YELLOW TIPPED	INPUT D-C AMPLIFIER	67V	0	3V	6.3 VAC		67V	0	3V		(1) Vertical amplifier tube reference symbols are the 100 series; for the horizontal amplifier, the 300 series. (2) Heaters of amplifiers are bootstrapped approximately 90 volts d-c above ground. (3) CRT spot is centered for all voltage measurements.
			100K	220K	1.7K	35K	35K	100K	220K	1.7K	35K	
V102 or V302	12AU7	D-C AMPLIFIER	120V	67V	69V	6.3 VAC		120V	67V	69V		
			80K	100K	33K	35K	35K	80K	100K	33K	35K	
V103 or V303	6BK7-A	VERTICAL OR HORIZONTAL DEFLECTION D-C AMPLIFIER	250V	120V	123V	6.3 VAC		250V	120V	123 V	0 Shield	
			320K	80K	12K	35K	35K	320K	80K	12K	0 Shield	

TABLE 4-2

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 340 (Continued)

TYPE 340 SYNC AND SWEEP CIRCUITS

TUBE			PIN NUMBERS								COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V201	12AX7	(A) SYNC PHASE SPLITTER	145V	6.5V	6.5V			60V 6.3 VAC	0	0		(1) All heaters are bootstrapped approximately 90 volts d-c above ground. (2) Pin 7 varies with SYNC AMPLITUDE setting.
		(B) SYNC AMPLIFIER	60K	2.2M	10K	35K	35K	170K	0 to 100K	0	35K	
V202	6U8	(A) 1/2 GATE GENERATOR	60V	58V	153V	6.3 VAC		105V	62V	105V	60V	(1) Same as above except reference to pin 7. (2) Rotate MODE (service adjustment R213) fully CW to disable the gate generator when taking voltage measurements.
		(B) SERIES TRIGGERING DIODE	170K	200K	50K	35K	35K	62K	12K	62K	170K	
V203	6U8	(A) 1/2 GATE GENERATOR	390V	40V	153V	6.3 VAC		153V	62V	160V	153V	
		(B) GATE CATHODE FOLLOWER	300K	530K	50K	35K	35K	60K	12K	56K	60K	
V204	12AT7	(A) POSITIVE SAW GENERATOR	150V*	155V	153V			390V 6.3 VAC	150V*	158V		(1) Same as above. (2) Pins 1 and 7 vary with VERNIER setting. (3) *Measure with meter of 20-megohm impedance (Simpson 260 on 1000 V scale) or Electronic voltmeter.
		(B) POSITIVE SAW CATHODE FOLLOWER	550K to 5M	60K	50K	35K	35K	300K	550K to 5M	36K	35K	

TABLE 4-2

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 340 (Continued)

TYPE 340 CRT AND BEAM CIRCUITS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1 | 14	2	3	5	7	8	9	10	11	
V401	5AQP-	CATHODE-RAY TUBE	6.3 VAC	0	−5 to −65V	0 to 380V	1450V	1450V	1450V	1450V	1450V	WARNING HIGH VOLTAGE 1500 V)
			1.8M	1.7 to 1.8M	1.7M	1.2 to 1.6M	320K	320K	350K	320K	320K	(1) V & R measurements taken with respect to CRT cathode (yellow wire). (2) Heater is bootstrapped to −1200 V supply. (3) Pins 2 and 3 vary with INTENSITY setting. (4) Pin 5 varies with INTENSITY and FOCUS setting.
			1	2	3	4	5	6	7	8	9	
V402	12AU7	BEAM GATE GENERATOR	50V	3V	7V			15V	7.2V	7V		WARNING HIGH VOLTAGE (−1200 V) FROM TUBE PINS TO GROUND
								6.3 VAC				
			1.7M	1.8M	1.8M	1.8M	1.8M	1.7M	1.8M	1.8M	1.8M	(1) V & R measurements taken with respect to −1200 V supply (white wire). (2) Heater is bootstrapped to −1200 V supply.

TABLE 4-2

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 340 (Continued)

TYPE 340 R-F SUPPLY CIRCUITS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V501	6AQ5	R-F POWER OSCILLATOR	−25V	0	⌊6.3 VAC⌋		200V	100V				V & R measurements taken with respect to +150-volt supply.
			80K	50K	35K	35K	320K	90K				
V502	1X2A	HIGH-VOLTAGE RECTIFIER	DO NOT MEAS	DO NOT MEAS								PLATE CAP −1500 V
			45	45								1.8M

TYPE 340 LOW VOLTAGE POWER SUPPLY CIRCUIT

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V601	5Y3-GT	LOW-VOLTAGE RECTIFIER		415V	420 VAC	420 VAC		120 VAC		415V		Heater voltage measures 5 VAC between pins 2 & 8.
				300K	20	20		20		300K		
V602	0A2	150 V SUPPLY REGULATOR	150V	0		0	150V		0			
			50K	0		0	50K		0			

TABLE 4-3

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 341

Preset front-panel controls according to the following chart:

CONTROL	SETTING	CONTROL	SETTING	CONTROL	SETTING
INTENSITY	For normal trace	(X) AMPLITUDE	Fully CW	VERNIER	Any position
FOCUS	Focused trace	Y SELECTOR	OFF	X D-C BAL	For balanced condition
X POSITION	To center trace	(Y) AMPLITUDE	Fully CW	Y D-C BAL	
Y POSITION	To center trace	SYNC AMPLITUDE	0		
X SELECTOR	OFF	SWEEP RANGE	Any position		

WARNING

PERSONAL CONTACT WITH THE +390-VOLT SUPPLY MAY PROVE *FATAL*

TYPE 341 VERTICAL AND HORIZONTAL AMPLIFIERS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V101 or V301	12AU7 YELLOW TIPPED	D-C AMPLIFIER	45V	6V	6.8V			45V	6V	6.8V		(1) Vertical amplifier tube reference symbols are the 100 series; for the horizontal amplifier, the 300 series.
							6.3 VAC					
			90K	1.9K	1.6K	35K	35K	90K	1.9K	1.6K	35K	
V102 or V302	12AU7	D-C AMPLIFIER	110V	45V	48V			110V	45V	48V		(2) Heaters of amplifiers are bootstrapped approximately 90 volts d-c above ground.
							6.3 VAC					
			70K	90K	10K	35K	35K	70K	90K	10K	35K	
V103 or V303	6BK7-A	VERTICAL OR HORIZONAL DEFLECTION D-C AMPLIFIER	260V	110V	113V			260V	110V	113V	0	(3) CRT spot is centered for all voltage measurements.
						6.3 VAC						
			90K	70K	12K	35K	35K	90K	70K	12K	0	
V104 or V304	12AU7 YELLOW TIPPED	INPUT D-C CATHODE FOLLOWER	155V	0	6V			155V	0	6V		
							6.3 VAC					
			50K	220K	1.9K	35K	35K	50K	220K	1.9K	35K	

TABLE 4-3

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 341 (Continued)

TYPE 341 SYNC AND SWEEP CIRCUITS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V201	12AX7	(A) SYNC PHASE SPLITTER	145V	6.5V	6.5V			60V	0	0		(1) All heaters are bootstrapped approximately 90 volts d-c above ground. (2) Pin 7 varies with SYNC AMPLITUDE setting.
								6.3 VAC				
		(B) SYNC AMPLIFIER	70K	2.2M	10K	35K	35K	170K	0 to 100K	0	35K	
V202	6U8	(A) 1/2 GATE GENERATOR	60V	58V	153V			105V	62V	105V	60V	
						6.3 VAC						
		(B) SERIES TRIGGERING DIODE	170K	200K	60K	35K	35K	72K	12K	72K	170K	(1) Same as above except reference to pin 7. (2) Rotate MODE (service adjustment R213) fully CW to disable the gate generator when taking voltage measurements.
V203	6U8	(A) 1/2 GATE GENERATOR	390V	40V	153V			153V	62V	160V	153V	
						6.3 VAC						
		(B) GATE CATHODE FOLLOWER	70K	530K	60K	35K	35K	75K	12K	56K	75K	
V204	12AT7	(A) POSITIVE SAW GENERATOR	150V*	155V	153V			390V	150V*	158V		(1) Same as above. (2) Pins 1 and 7 vary with VERNIER setting. (3) *Measure with meter of 20-megohm impedance (Simpson 260 on 1000 V scale) or Electronic voltmeter.
								6.3 VAC				
		(B) POSITIVE SAW CATHODE FOLLOWER	550K to 5M	60K	60K	35K	35K	70K	550K to 5M	36K	35K	

TABLE 4-3

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 341 (Continued)

TYPE 341 CRT AND BEAM GATE CIRCUITS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1 | 14	2	3	5	7	8	9	10	11	
V401	5AQP-	CATHODE-RAY TUBE	6.3 VAC	0	−5 to −65V	0 to 380V	1450V	1450V	1450V	1450V	1450V	WARNING HIGH VOLTAGE (1500 V)
			1.8M	1.7 to 1.8M	1.7M	1.2 to 1.6M	90K	90K	65K	90K	90K	(1) V & R measurements taken with respect to CRT cathode (yellow wire). (2) Heater is bootstrapped to −1200 V supply. (3) Pins 2 and 3 vary with INTENSITY setting. (4) Pin 5 varies with INTENSITY and FOCUS settings.
			1	2	3	4	5	6	7	8	9	
V402	12AU7	BEAM GATE GENERATOR	50V	3V	7V	6.3 VAC		15V	7.2V	7V	6.3 VAC	WARNING HIGH VOLTAGE (−1200 V) FROM TUBE PINS TO GROUND
			1.7M	1.8M	1.8M	1.8M	1.8M	1.7M	1.8M	1.8M	1.8M	(1) V & R measurements taken with respect to −1200 V supply (white wire). (2) Heater is bootstrapped to −1200 V supply.

TABLE 4-3

VOLTAGE AND RESISTANCE MEASUREMENTS FOR TYPE 341 (Continued)

TYPE 341 R-F SUPPLY CIRCUITS

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V501	6AQ5	R-F POWER OSCILLATOR	–25V	0	└6.3 VAC┘		250V	200V				V & R measurements taken with respect to +150-volt supply.
			90K	60K	35K	35K	70K	420K				
V502	1X2A	HIGH-VOLTAGE RECTIFIER	DO NOT MEAS	DO NOT MEAS								PLATE CAP –1500 V
			45	45								1.8M

TYPE 341 LOW VOLTAGE POWER SUPPLY CIRCUIT

TUBE			PIN NUMBERS									COMMENTS
Symbol	Type	Function	1	2	3	4	5	6	7	8	9	
V601	5Y3-GT	LOW-VOLTAGE RECTIFIER		415V	420 VAC	420 VAC		420 VAC		415V		Heater voltage measures 5 VAC between pins 2 & 8.
				70K	20	20		20		70K		
V602	0A2	150 V SUPPLY REGULATOR	150V	0		0	150V		0			
			60K	0		0	50K		0			

TABLE 4-4
ADJUSTMENTS TO BE MADE WHEN REPLACING TUBES

Tubes not shown require no readjustment upon replacement

Tube Reference Symbol	Tube Type	Service Adjustments (Refer to paragraph 4)	
		Type 340	Type 341
V101	12AU7-Y	ASTIG ADJ (R118), HUM BAL (R603) and Hum Harmonic Trimmer (C119)	ASTIG ADJ (R416), H-F Compensation (C123 and C124), and Phase Shift Trimmer (C118)
V102	12AU7	ASTIG ADJ (R118)	Same as V101
V103	6BK7-A	Same as V102	Same as V101
V104	12AU7-Y	Not applicable	Same as V101
V204	12AT7	MODE (R213)	MODE (R213)
V301	12AU7-Y	ASTIG ADJ (R118), HUM BAL (R603) and Hum Harmonic Trimmer (C319)	ASTIG ADJ (R416), H-F Compensation (C323 and C324), and Phase Shift Trimmer (C118)
V302	12AU7	ASTIG ADJ (R118)	Same as V301
V303	6BK7-A	Same as V302	Same as V301
V304	12AU7-Y	Not applicable	Same as V301
V501	6AQ5	HV ADJ (R503)	HV ADJ (R503)
V502	1X2-A	HV ADJ (R503)	HV ADJ (R503)
V601	5Y3-GT	HV ADJ (R503)	HV ADJ (R503)
V602	OA2	HV ADJ (R503) and MODE (R213)	HV ADJ (R503) and MODE (R213)

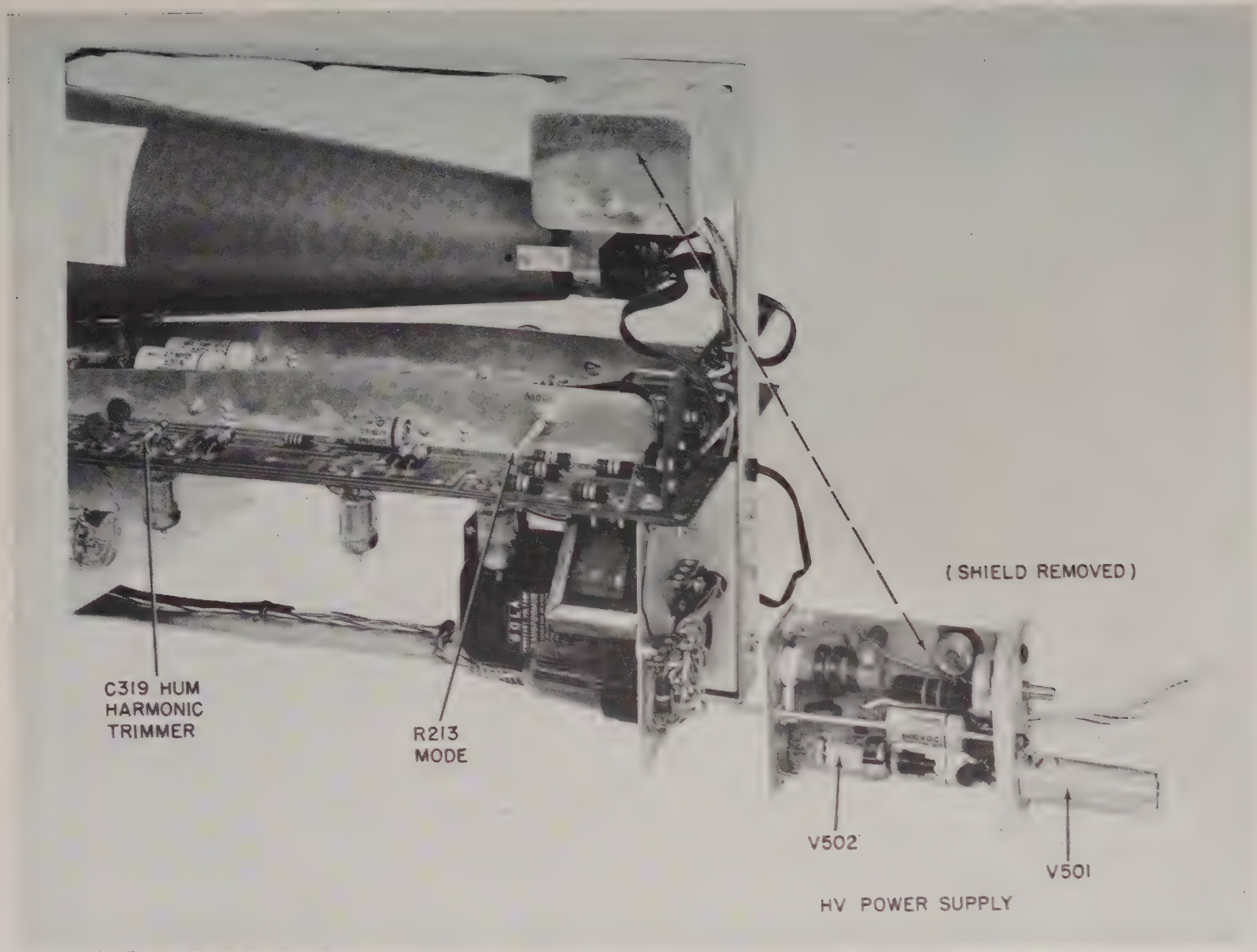


FIGURE 4-2. TYPE 340: TUBE LOCATION AND SERVICE ADJUSTMENTS

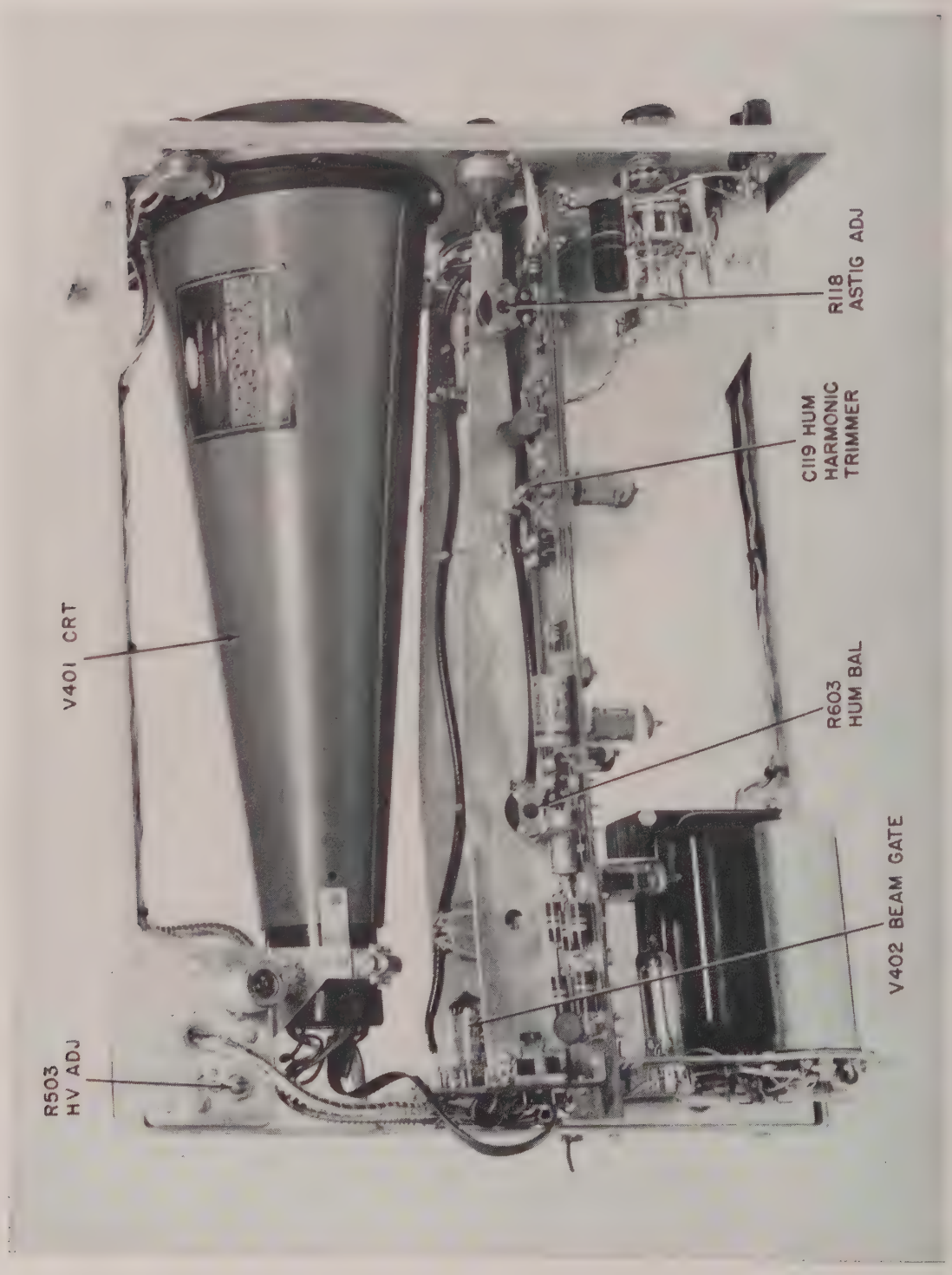


FIGURE 4-3. TYPE 340: TUBE LOCATION AND SERVICE ADJUSTMENTS

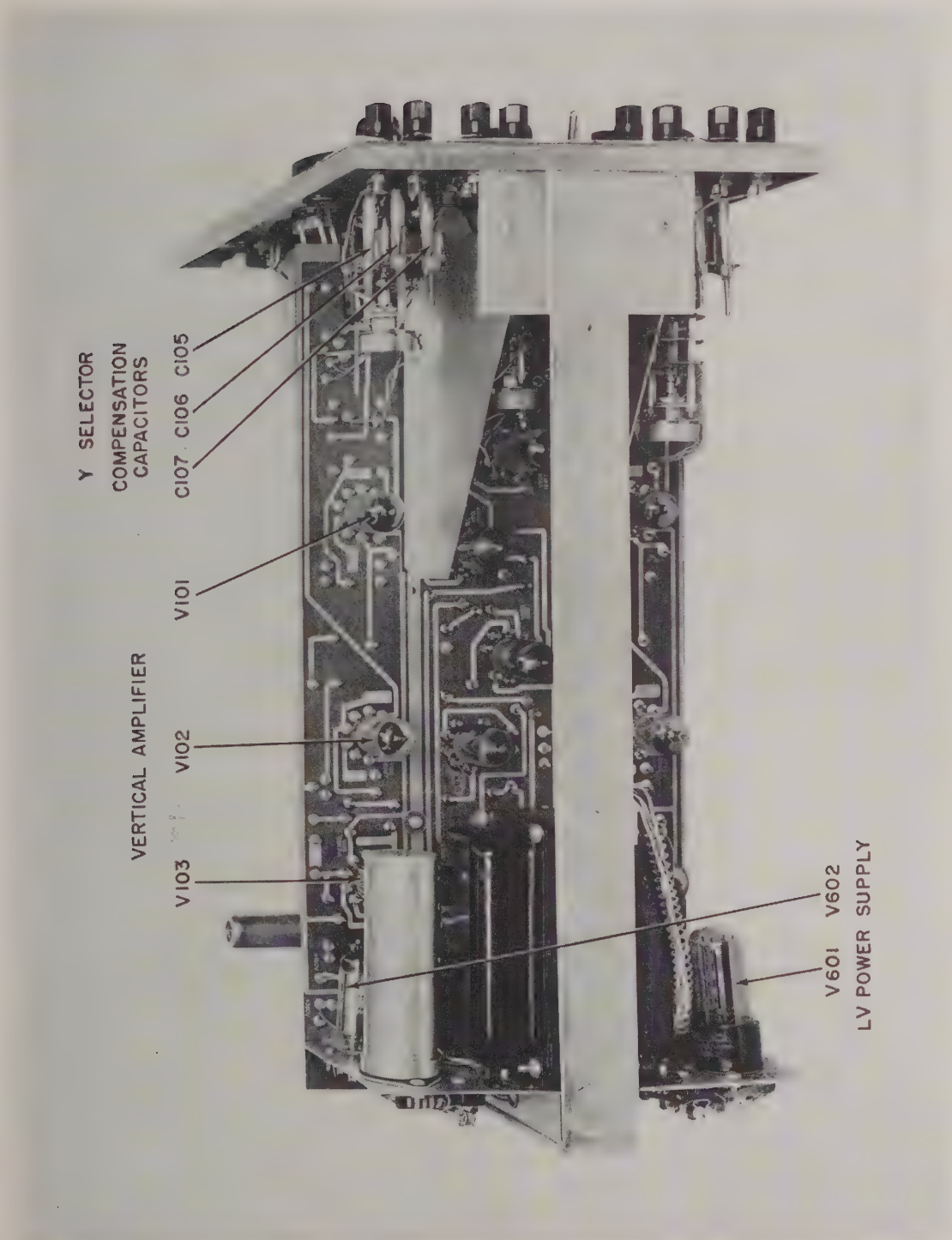


FIGURE 4-4. TYPE 340: TUBE LOCATION AND SERVICE ADJUSTMENTS

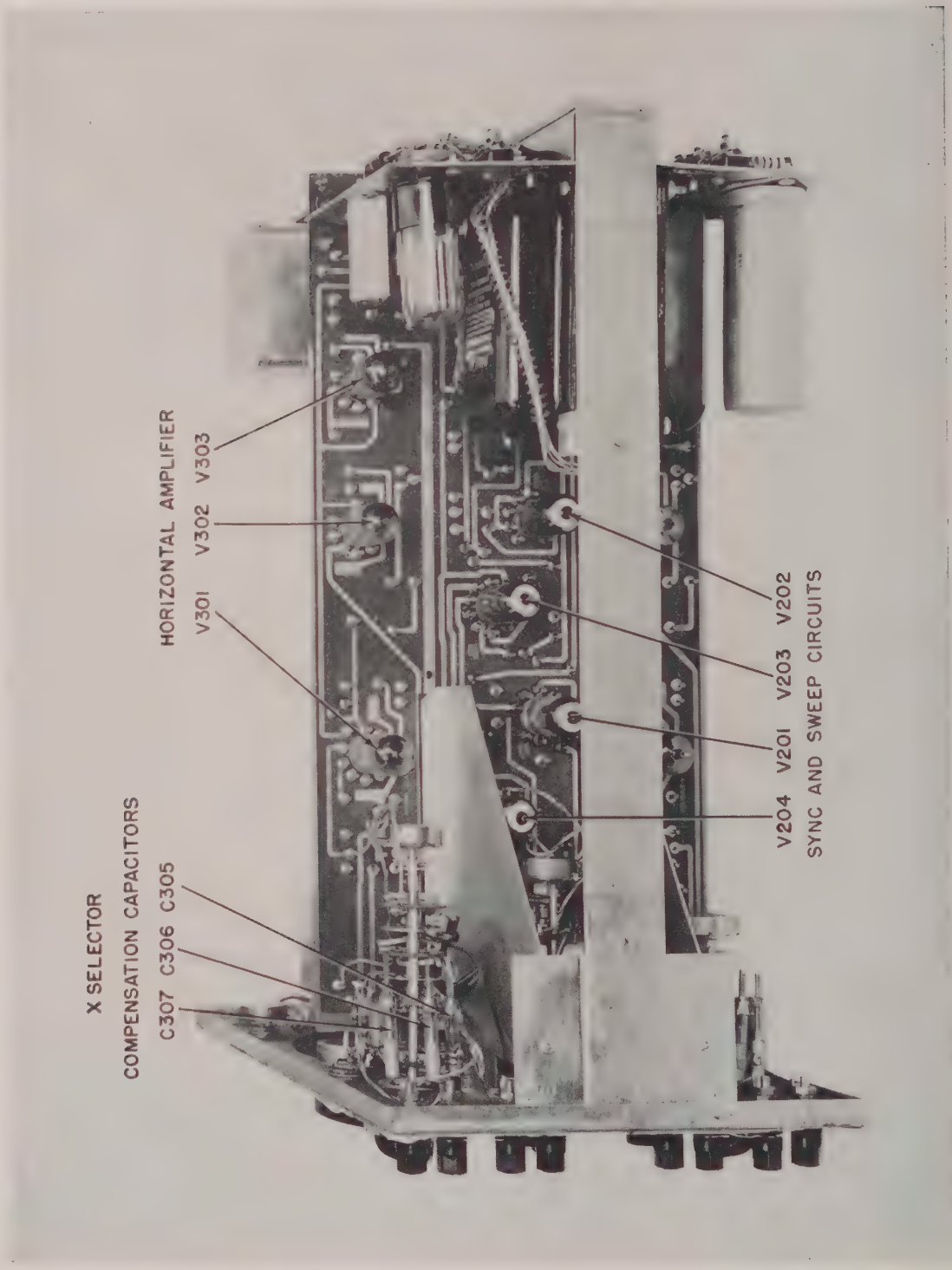


FIGURE 4-5. TYPE 340: TUBE LOCATION AND SERVICE ADJUSTMENTS

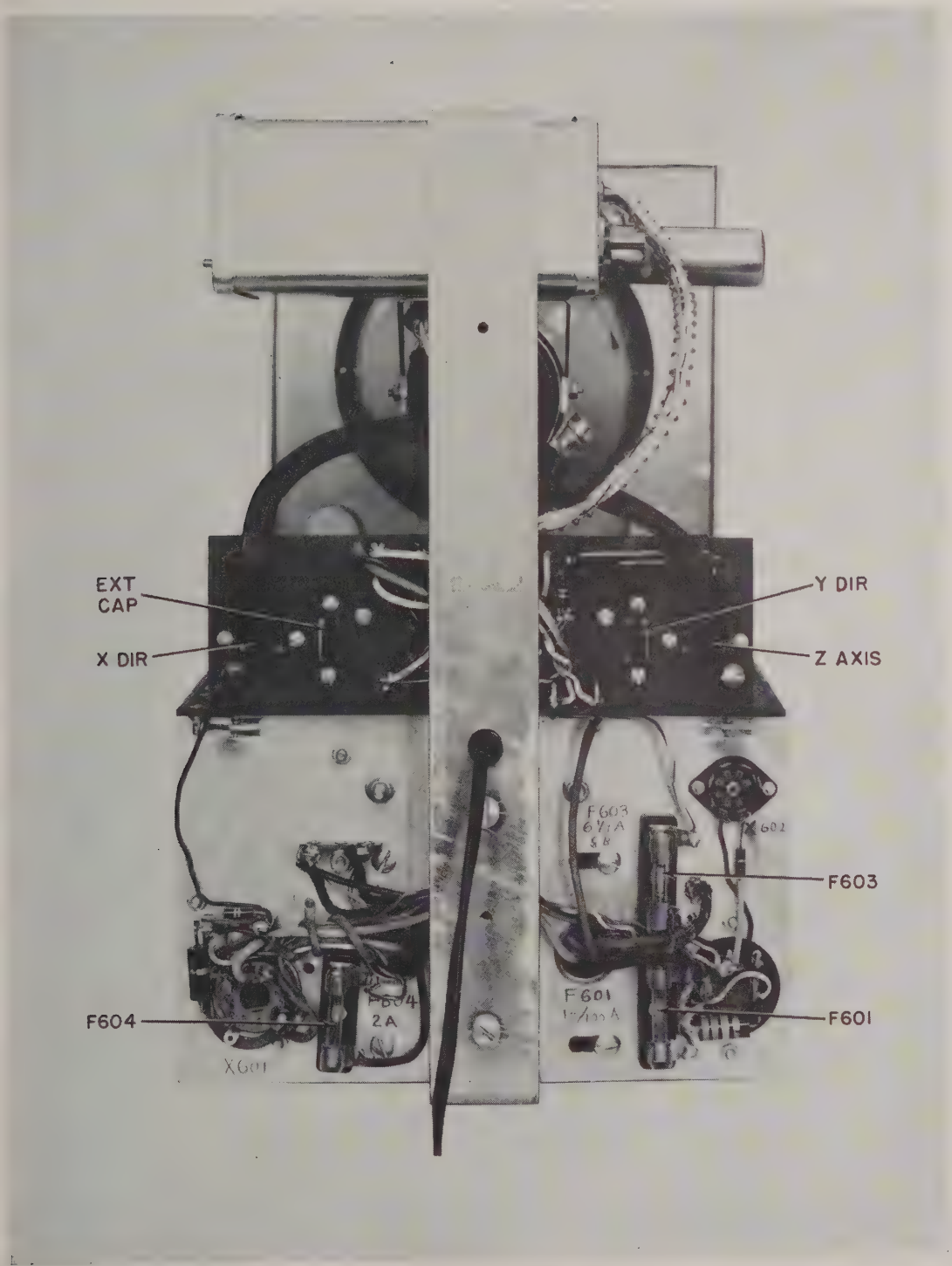


FIGURE 4-6. TYPE 340: FUSE LOCATION AND REAR-PANEL FACILITIES

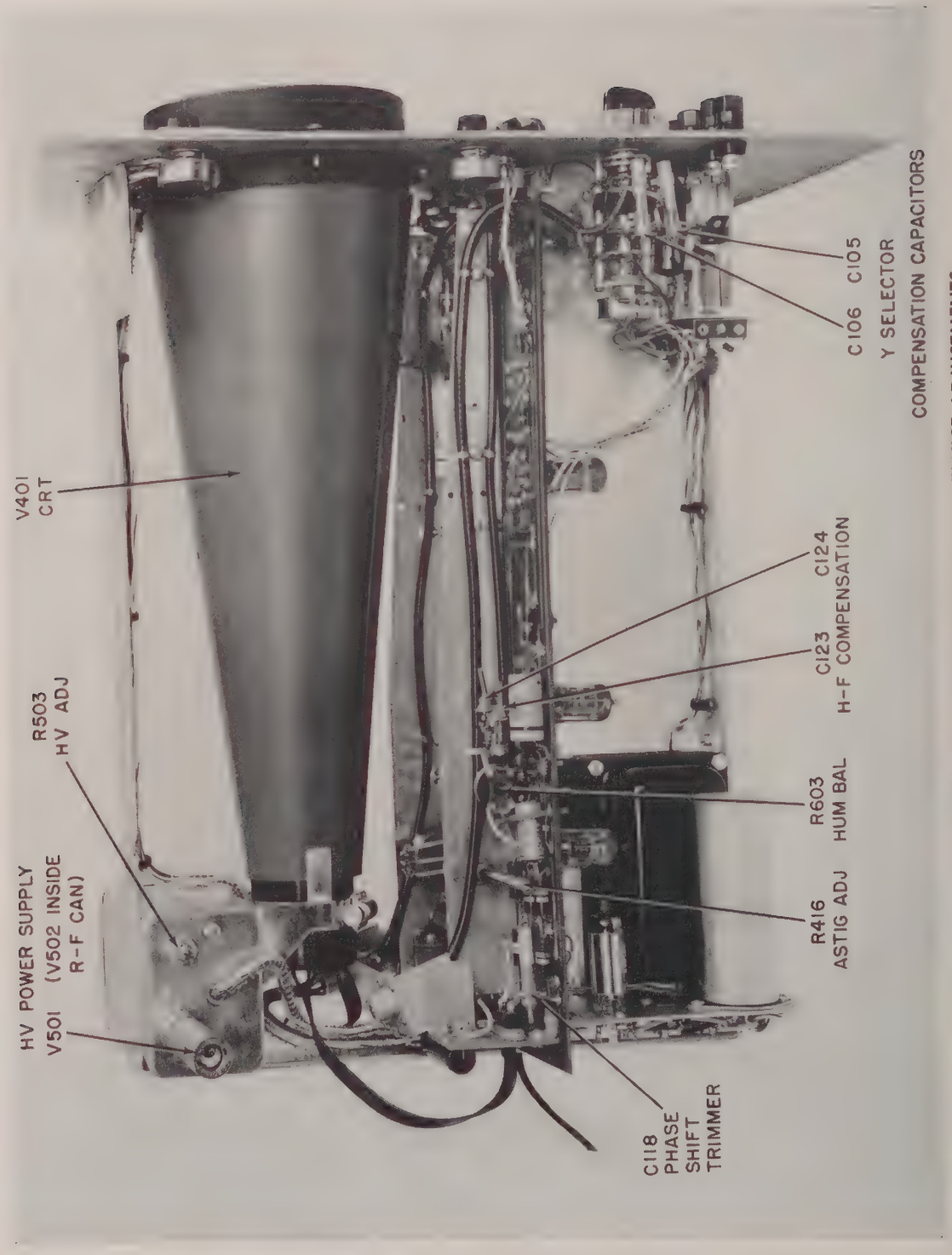


FIGURE 4-7. TYPE 341-R: TUBE LOCATION AND SERVICE ADJUSTMENTS

FIGURE 4-8. TYPE 341-R: TUBE LOCATION AND SERVICE ADJUSTMENTS

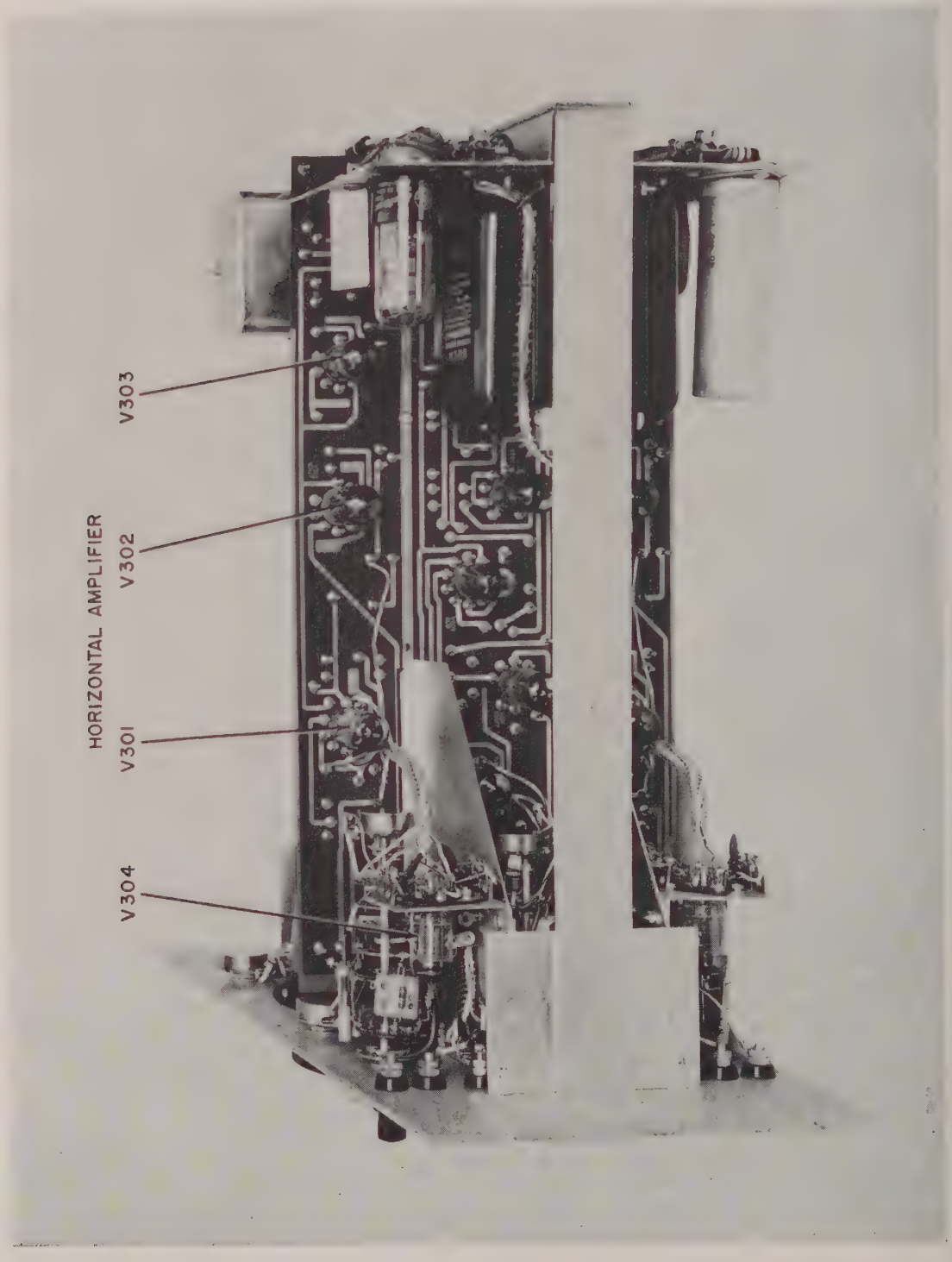


FIGURE 4-9. TYPE 341-R: TUBE LOCATION

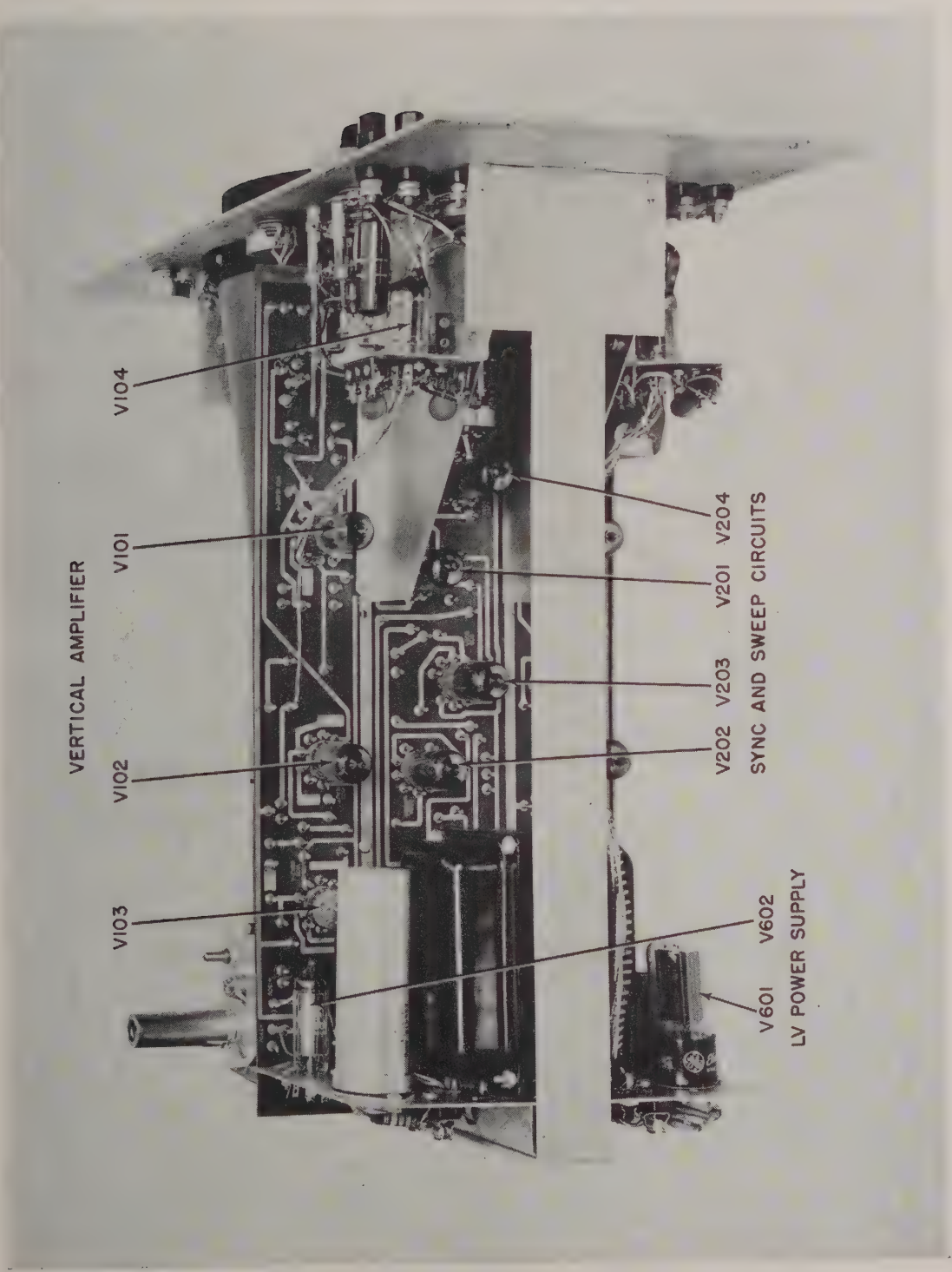


FIGURE 4-10. TYPE 341-R: TUBE LOCATION

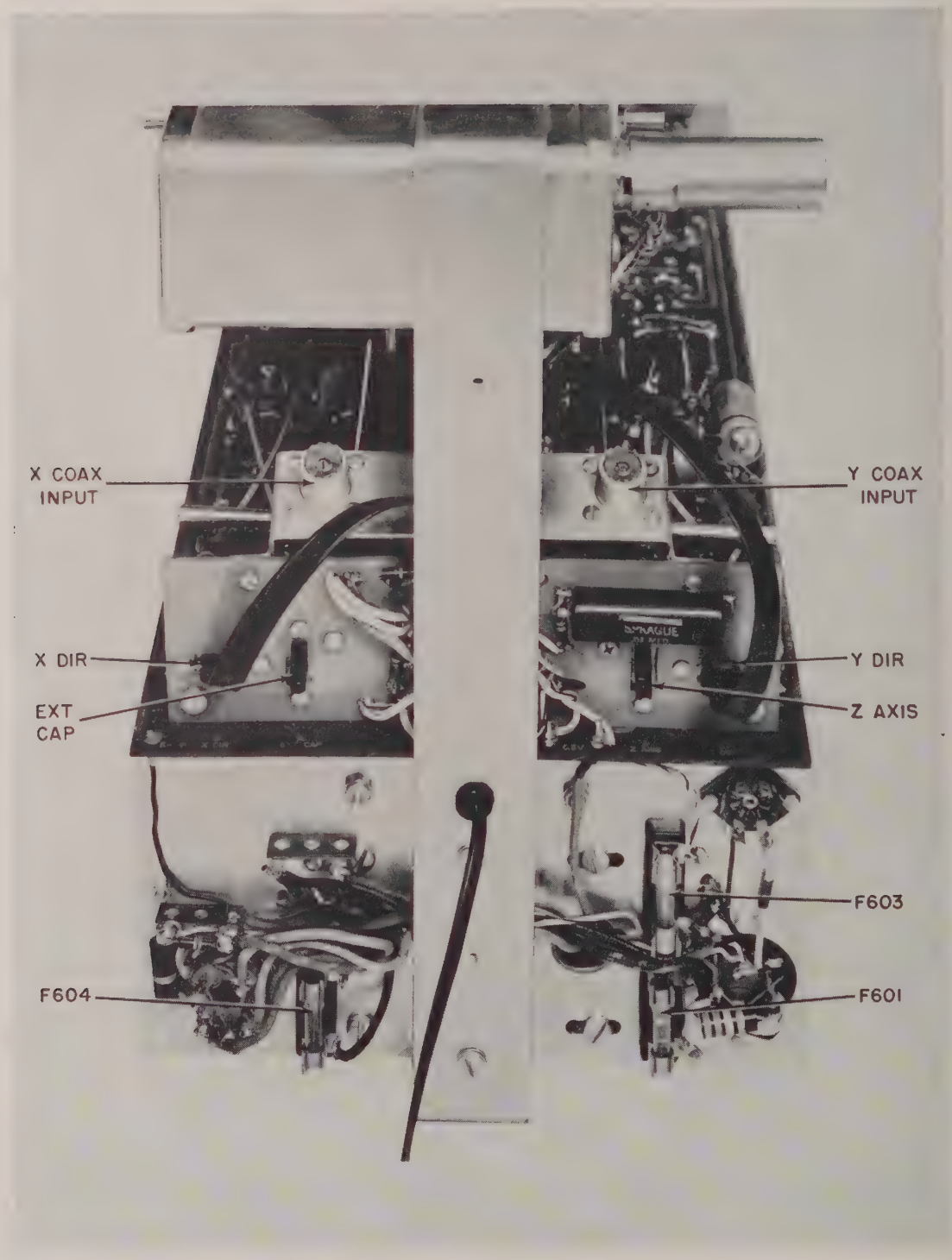


FIGURE 4-11. TYPE 341-R: FUSE LOCATION AND REAR-PANEL FACILITIES

TYPE 340/340-R CATHODE-RAY OSCILLOGRAPH

COMPONENT PARTS LIST

Symbol	*Part Number*	*Description*
	CAPACITORS	
C101	03128220	0.1 μf 20% 600V Paper
C102	03020390	47 μμf 10% 500V Mica
C103	03029430	820 μμf 10% 500V Mica
C104	03033650	8200 μμf 10% 500V Mica
C105	03163620	1-12 μμf 500V Variable, Glass
C106	Same as C105	
C107	Same as C105	
C108	03019650	0.01 μf 450V Ceramic
C109	Same as C108	
C112	03017040	4 μf 250V Elect
C118	Same as C108	
C119	03155000	0.7-3 500V Variable, Plastic
C201	03015340	1 μf 200 V Paper
C202	03004170	0.05 μf +20%-10% 600V, Paper
C203	03140400	0.47 μf 20% 200V Paper
C204	Same as C203	
C205	03020310	10 μμf 10% 500V Mica
C207	03020390	47 μμf 10% 500V Mica
C208	Same as C108	
C210	Same as C207	
C211	03020450	150 μμf 10% 500V Mica
C212	Same as C103	
C213	Same as C104	
C214	03140330	0.033 μf 20% 200V Paper
C215	03140380	0.22 μf 20% 200V Paper
C216	Same as C108	
C301	Same as C101	
C302	Same as C102	
C303	Same as C103	
C304	Same as C104	
C305	Same as C105	
C306	Same as C105	
C307	Same as C105	
C308	Same as C108	
C309	Same as C108	
C312	Same as C112	
C319	Same as C119	
C401	03100510	400 μμf 20% 2 KV Mica
C402	03164930	0.01 μf 20% 2 KV Ceramic
C501	Same as C402	
C502	Same as C402	
C503	03143461	1.5 μμf 5 KV Ceramic
C504	03127620	0.1 μf 20% 400V Paper
C505	Same as C108	
C601 A, B, C	03126030	40/80/20 μf 450V Elect
C602	Part of T601	0.85 μf 850V Paper
C603	Same as C201	
C604	Same as C201	
C605	Same as C201	
	NEON REGULATORS	
E201	12007161	Lamp Glow ST2-32-1
E202	Same as E201	
	FUSES	
F601	11000880	15/100 Amp, Slow Blow
F603	11001280	6-¼ Amp, Slow Blow
F604	11000780	2 Amp
	LAMPS	
I601	12007700	Light Indicator
	CONNECTOR FEMALE	
J101	51001290	Binding Post
J102	Same as J101	
J103	51007080	Binding Post
J104	09041290	2 Contact (Mates with P101)
J201	Same as J101	
J202	Same as J101	
J203	Same as J104	
J301	Same as J101	
J302	Same as J101	
J303	Same as J103	
J304	Same as J104	
J401	Same as J104	
	INDUCTORS	
L501	21003810	9100 UH
L601	21004301	10 HY
	CONNECTOR MALE	
P101	09041300	2 Contact (Mates with J104)
P203	09041460	2 Contact
P301	Same as P101	
P401	Same as P203	
	RESISTORS	
R101	02041270	2 Meg 5% ½W
R102	02041050	240,000 ohms 5% ½W
R103	02040790	20,000 ohms 5% ½W
R104	02040550	2,000 ohms 5% ½W
R105	Same as R101	
R106	Same as R101	
R107	02032560	220,000 ohms 20% ½W
R108	Same as R107	
R109	02031780	1,200 ohms 10% ½W
R110	01011010	1,000 ohms 20% ½W, Variable
R111	02037930	22,000 ohms 10% 2W
R112	Same as R111	
R113	02034950	33,000 ohms 10% 1W
R114	01067700	100,000 ohms 20% ½W, Variable (Part of Sw. Assy. S101)
R115	Same as R109	
R118	01066190	10,000 ohms 20% ½W, Variable
R119	02034940	27,000 ohms 10% 1W
R120	Same as R110	
R121	Same as R111	
R122	Same as R111	
R123	02037900	12,000 ohms 10% 2W
R126	Same as R123	
R127	Same as R123	
R128	02032020	120,000 ohms 10% ½W
R129	Same as R128	
R130	02032010	100,000 ohms 10% ½W
R131	Same as R123	
R132	Same as R123	
R201	02032080	390,000 ohms 10% ½W
R202	02032170	2.2 Meg 10% ½W
R203	02031880	8,200 ohms 10% ½W
R204	02031800	1,800 ohms 10% ½W
R205	02031890	10,000 ohms 10% ½W
R206	01014200	200,000 ohms 20% ½W, Variable
R207	02038020	120,000 ohms 10% 2W
R208	02032090	470,000 ohms 10% ½W
R209	02037850	4,700 ohms 10% 2W
R210	02032140	1.2 Meg 10% ½W
R211	02032130	1 Meg 10% ½W
R212	02034900	12,000 ohms 10% 1W
R213	01067900	10,000 ohms 20% 2W, Variable
R214	Same as R211	
R215	Same as R210	
R216	Same as R209	
R217	02034980	56,000 ohms 10% 1W
R218	02031840	3,900 ohms 10% ½W
R219	02032070	330,000 ohms 10% ½W
R220	02035050	220,000 ohms 10% 1W
R221	02031130	510,000 ohms 5% ½W

Symbol	Part Number	Description
R222	02030760	15,000 ohms 5% ½W
R223	01064910	5 Meg 20% ½W, Variable (Part of Sw. Assy. S202)
R224	02031090	360,000 ohms 5% ½W
R225	02038010	100,000 ohms 10% 2W
R226	02031770	1,000 ohms 10% ½W
R227	02036730	11,000 ohms 5% 2W
R228	02109380	25,000 ohms 5% 5W, Wire Wound
R229	02030450	750 ohms 5% ½W
R230	02036930	75,000 ohms 5% 2W
R231	02038060	270,000 ohms 10% 2W
R232	02038070	330,000 ohms 10% 2W
R301	Same as R101	
R302	Same as R102	
R303	Same as R103	
R304	Same as R104	
R305	Same as R101	
R306	Same as R101	
R307	Same as R107	
R308	Same as R107	
R309	Same as R109	
R301	Same as R110	
R311	Same as R111	
R312	Same as R111	
R313	Same as R113	
R314	Same as R114	(Part of Sw. Assy. S301)
R315	Same as R109	
R319	Same as R113	
R320	Same as R110	
R321	Same as R111	
R322	Same as R111	
R323	Same as R123	
R326	Same as R123	
R327	Same as R123	
R331	Same as R123	
R332	Same as R123	
R401	Same as R205	
R402	02031030	200,000 ohms 5% ½W
R403	Same as R208	
R404	02031980	56,000 ohms 10% ½W
R405	02031000	150,000 ohms 5% ½W
R406	Same as R208	
R407	Same as R404	
R408	Same as R202	
R409	02031950	33,000 ohms 10% ½W
R410	Same as R128	
R411	01011110	500,000 ohms 20% ½W, Variable
R413	Same as R411	
R414	Same as R210	
R501	Same as R119	
R502	Same as R409	
R503	01009860	100,000 ohms 20% ½W, Variable
R601	Same as R404	
R602	02031940	27,000 ohms 10% ½W
R603	01066090	500 ohms 20% ½W, Variable
R604	02031930	22,000 ohms 10% ½W
R605	02038130	1 Meg 10% 2W
R606	02031690	220 ohms 10% ½W
R607	Same as R232	

SWITCHES

S101	05005994	Rotary 4P10T (Part of Sw. Assy. 05005993)
S201	05009662	Rotary 1P3T
S202	05009674	Rotary 1P7T (Part of Sw. Assy. 05009673)
S301	05010452	Rotary 6P11T (Part of Sw. Assy. 05010451)
S601	05001130	Toggle SPST

TRANSFORMERS

T501	20007311	RF HV
T601	20007292	Power

TUBES

V101	25001130	12AU7
V102	Same as V101	
V103	25008560	6BK7A
V201	25001500	12AX7
V202	25007310	6U8
V203	Same as V202	
V204	25001530	12AT7
V301	Same as V101	
V302	Same as V101	
V303	Same as V103	
V401	25008700 or	5AQP-1
	25008710 or	5AQP-2
	25008720 or	5AQP-7
	25008730	5AQP-11
V402	Same as V101	
V501	25000340	6AQ5
V502	25006490	1X2A
V601	25000220	5Y3GT
V602	25000300	OA2

CABLE

W601	50110700	Power

TYPE 341/341-R CATHODE-RAY OSCILLOGRAPH

COMPONENT PARTS LIST

CAPACITORS

Symbol	*Part Number*	*Description*
C101	03128220	0.1 μf 20% 600V Paper
C102	03020390	47 μμf 10% 500V Mica
C103	03029430	820 μμf 10% 500V Mica
C105	03163620	1-12 μμf 500V Variable Glass
C106	Same as C105	
C108	03019650	0.01 μf 450V Ceramic
C109	Same as C108	
C112	03017040	4 μf 250V Elect.
C118	Same as C105	
C123	03163600	0.5 3 μμf 500V Variable Glass
C124	Same as C123	
C125	Same as C101	
C201	03127620	0.1 μf 20% 400V Paper
C202	03004170	0.05 μf +20%–10% 600V Paper
C203	03140400	0.47 μf 20% 200V Paper
C204	Same as C203	
C205	03020310	10 μμf 10% 500V Mica
C207	03020390	47 μμf 10% 500V Mica
C208	Same as C108	
C210	Same as C205	
C211	03020450	150 μμf 10% 500V Mica
C212	03029440	1,000 μμf 10% 500V Mica
C213	03033640	6,800 μμf 10% 300V Mica
C214	03140330	0.033 μf 20% 200V Paper
C215	03140380	0.22 μf 20% 200V Paper
C216	Same as C108	
C301	Same as C101	
C302	Same as C102	
C303	Same as C103	
C305	Same as C105	
C306	Same as C105	
C308	Same as C108	
C309	Same as C108	
C312	Same as C112	
C323	Same as C123	
C324	Same as C123	
C325	Same as C101	
C401	03100510	400 μμf 20% 2 KV Mica
C402	03164930	0.01 μf 20% 2 KV Ceramic
C403	Same as C108	
C501	Same as C402	
C502	Same as C402	
C503	03143461	1.5 μμf 5 KV Ceramic
C504	Same as C201	
C505	Same as C108	
C601 A, B, C	03126030	40/80/20 μf 450V Elect.
C602	Part of T601	0.85 μf 850V Paper
C603	03015340	1 μf 200V Paper
C604	Same as C603	
C605	Same as C603	

NEON REGULATORS

E201	12007161	ST2-32-1 Glow (Special Type)
E202	Same as E201	

FUSES

F601	11000880	Fuse Cart 15/100 Amp, Slow Blow
F603	11001280	Fuse Cart 6–¼ Amp, Slow Blow
F604	11000780	Fuse Cart 2 Amp.

LAMPS

I601	12007700	Light, neon, 75-250V AC or DC

CONNECTOR FEMALE

J101	51007080	Post Binding
J102	Same as J101	
J103	Same as J101	
J104	09041290	2 Contacts
J105	09005130	Coaxial Type
J201	Same as J101	
J202	Same as J101	
J203	Same as J104	
J301	Same as J101	
J302	Same as J101	
J303	Same as J101	
J304	Same as J104	
J305	Same as J105	
J401	Same as J104	

INDUCTORS

L501	21003810	9100 UH
L601	21004301	10H

CONNECTOR MALE

P101	09041300	2 contacts
P203	09041460	2 contacts
P301	Same as P101	
P401	Same as P203	

RESISTORS

R101	02041270	2 Meg 5% ½W, Metallized
R102	02041050	240,000 ohms 5% ½W, Metallized
R103	02040790	20,000 ohms 5% ½W, Metallized
R105	Same as R101	
R106	Same as R101	
R107	02032560	220,000 ohms 10% ½W
R108	Same as R107	
R110	01011010	1,000 ohms 10% ½W, Variable
R111	02030800	22,000 ohms 5% ½W
R112	Same as R111	
R113	02033790	20,000 ohms 5% 1W
R119	02033720	10,000 ohms 5% 1W
R120	Same as R110	
R121	02037930	22,000 ohms 10% 2W
R122	Same as R121	
R123	02037900	12,000 ohms 10% 2W
R126	Same as R123	
R127	Same as R123	
R130	02032010	100,000 ohms 10% ½W
R131	Same as R123	
R132	Same as R123	
R133	02041110	430,000 ohms 10% ½W, Metallized
R134	Same as R133	
R135	02031800	1800 ohms 10% ½W
R136	Same as R135	
R137	01067710	10,000 ohms 20% ½W, Variable (Part of Sw. Assy. S101)
R138	02031640	82 ohms 10% ½W
R139	02030520	1,500 ohms 5% ½W
R141	02031690	220 ohms 10% ½W
R142	Same as R141	
R143	02031770	1,000 ohms 10% ½W
R144	Same as R143	
R201	02032080	390,000 ohms 10% 1/2W
R202	02032170	2.2 Meg 10% ½W
R203	02031880	8,200 ohms 10% ½W
R204	Same as R135	
R205	02031890	10,000 ohms 10% ½W
R206	01014200	200,000 ohms 20% ½W, Variable
R207	02038020	120,000 ohms 10% 2W
R208	02032090	470,000 ohms 10% ½W
R209	02037850	47,000 ohms 10% 2W
R210	02032140	1.2 Meg 10% ½W
R211	02032130	1 Meg 10% ½W
R212	02034900	12,000 ohms 10% 1W
R213	01067900	10,000 ohms 20% 2W, Variable

Symbol	*Part Number*	*Description*
R214	Same as R211	
R215	Same as R210	
R216	Same as R209	
R217	02034980	56,000 ohms 10% 1W
R218	02031840	3,900 ohms 10% ½W
R219	02032070	330,000 ohms 10% ½W
R220	02035050	220,000 ohms 10% 1W
R221	02031130	510,000 ohms 5% ½W
R222	02030780	18,000 ohms 5% ½W
R223	01064910	5 Meg 20% ½W, Variable (Part of Sw. Assy. S202)
R224	02031090	360,000 ohms 5% ½W
R225	02038010	100,000 ohms 10% 2W
R226	Same as R143	
R227	02036730	11,000 ohms 5% 2W
R228	02109380	25,000 ohms 5% 5W
R229	02030450	750 ohms 5% ½W
R230	02036930	75,000 ohms 5% 2W
R231	02038060	270,000 ohms 10% 2W
R232	02038070	330,000 ohms 10% 2W
R301	Same as R101	
R302	Same as R102	
R303	Same as R103	
R305	Same as R101	
R306	Same as R101	
R307	Same as R107	
R308	Same as R107	
R310	Same as R110	
R311	Same as R111	
R312	Same as R111	
R313	Same as R113	
R319	Same as R119	
R320	Same as R110	
R321	Same as R121	
R322	Same as R121	
R323	Same as R123	
R326	Same as R123	
R327	Same as R123	
R331	Same as R123	
R332	Same as R123	
R333	Same as R133	
R334	Same as R133	
R335	Same as R135	
R336	Same as R135	
R337	Same as R137 (Part of Sw. Assy. S301)	
R338	Same as R138	
R339	Same as R139	
R341	Same as R141	
R342	Same as R141	
R343	Same as R143	
R344	Same as R143	
R401	Same as R205	
R402	02031030	200,000 ohms 5% ½W
R403	Same as R208	
R404	02031980	56,000 ohms 10% ½W
R405	02031000	150,000 ohms 5% ½W
R406	Same as R208	
R407	Same as R404	
R408	Same as R202	
R409	02031950	33,000 ohms 10% ½W
R410	02032020	120,000 ohms 10% ½W
R411	01011110	500,000 ohms 20% ½W, Variable
R413	Same as R411	
R414	Same as R210	
R415	02034920	18,000 ohms 10% 1W
R416	Same as R213	
R417	02034890	10,000 ohms 10% 1W
R501	02034940	27,000 ohms 10% 1W
R502	Same as R409	
R503	01009860	100,000 ohms 20% ½W, Variable
R601	02031960	39,000 ohms 10% ½W
R602	02031940	27,000 ohms 10% ½W
R603	01066090	500 ohms 20% ½W
R604	02031930	Variable
R605	02038130	22,000 ohms 10% ½W
R606	Same as R141	1 Meg 10% 2W
R607	Same as R232	

SWITCHES

S101	05005994	Rotary (Part of Sw. Assy. 05010501)
S201	05009662	Rotary
S202	05009674	Rotary (Part of Sw. Assy. 05009673)
S301	05010452	Rotary (Part of Sw. Assy. 05010491)
S601	05001130	Toggle SPST

TRANSFORMERS

T501	20007311	Radio Frequency, High Voltage
T601	20007292	Power

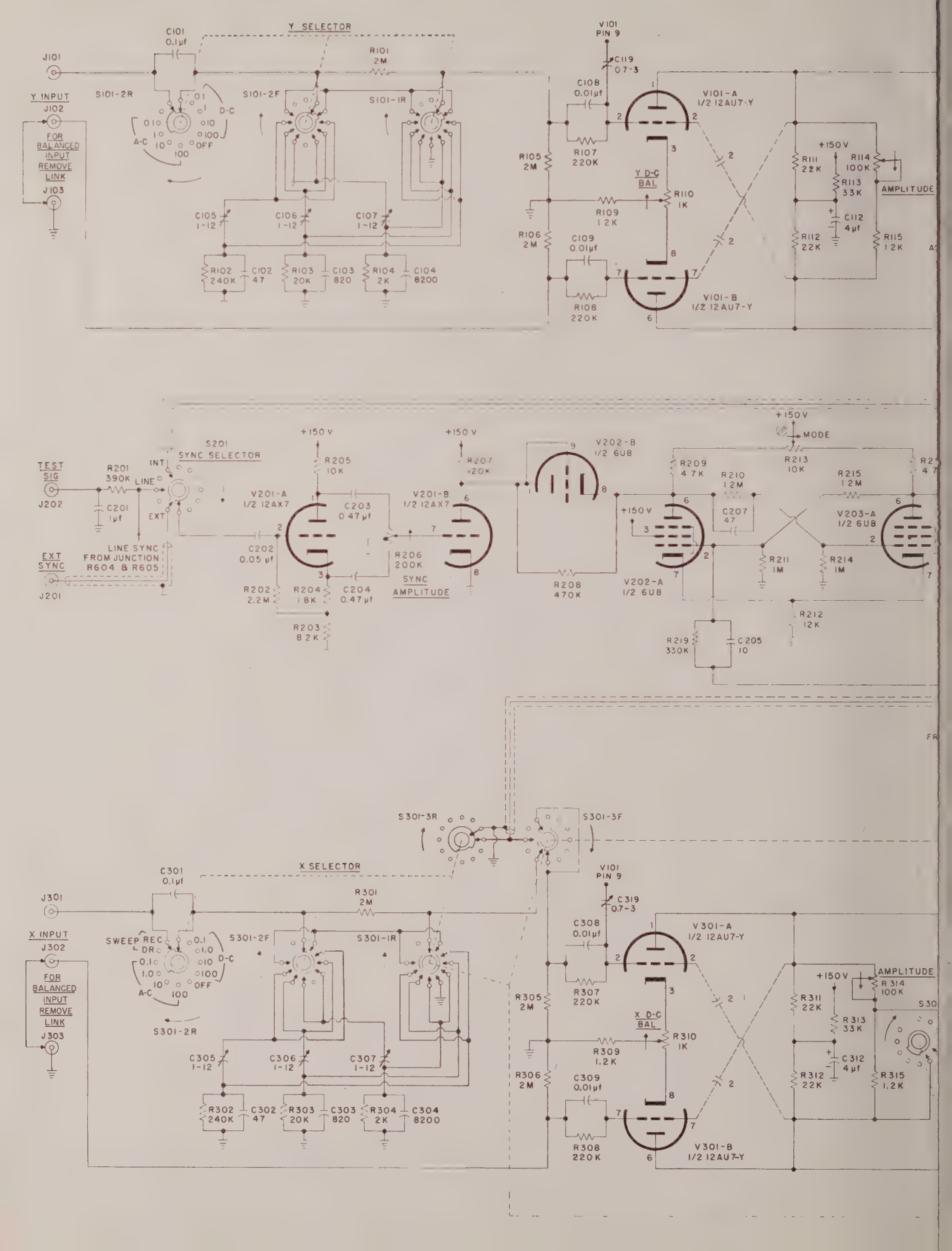
TUBES

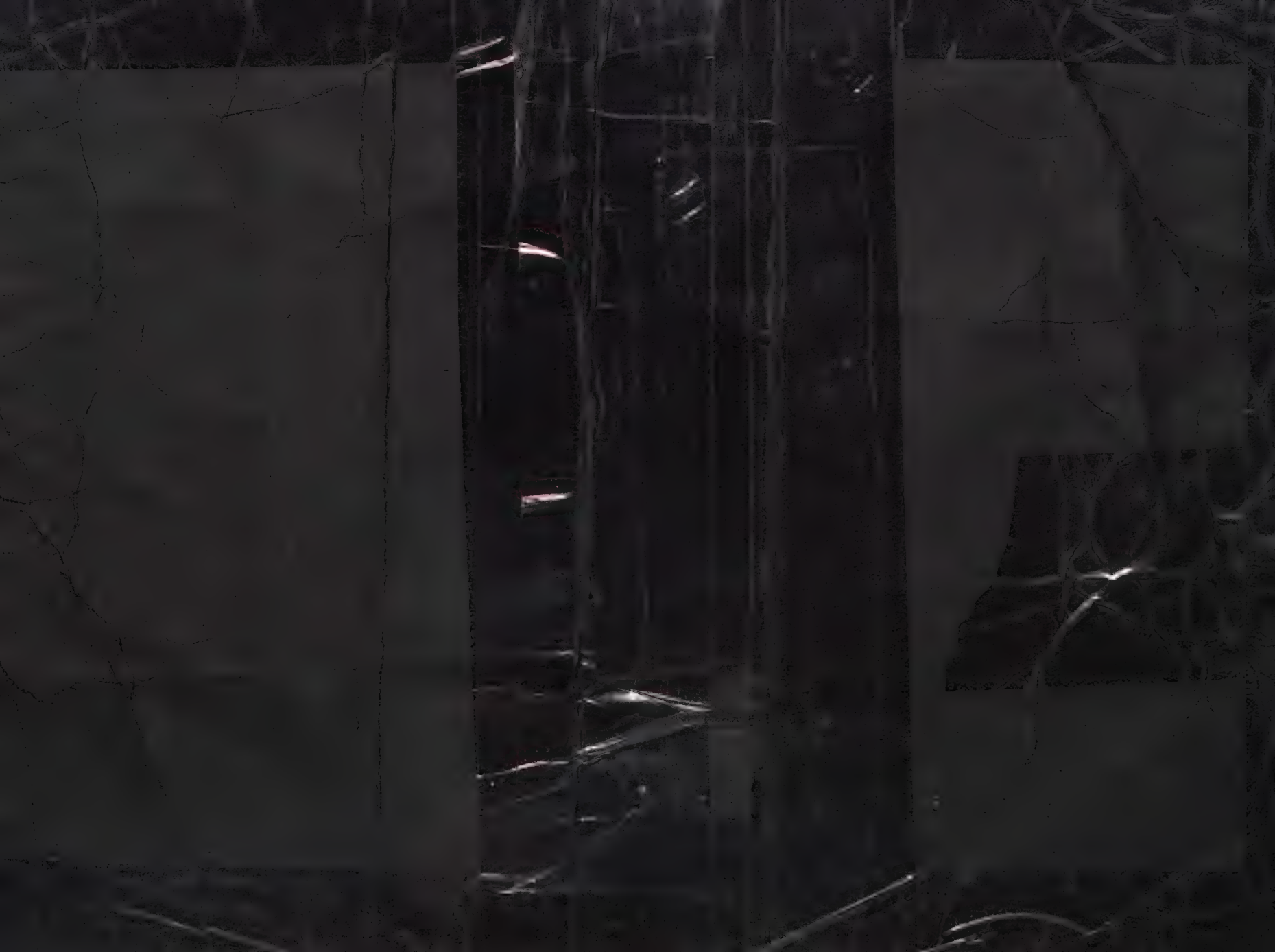
V101 A,B	25000130*	12AU7
V102 A,B	25000130	12AU7
V103 A,B	25008560	6BK7-A
V104 A,B	Same as V101	
V201 A,B	25001500	12AX7
V202 A,B	25007310	6U8
V203 A,B	Same as V202	
V204 A,B	25001530	12AT7
V301 A,B	Same as V101	
V302 A,B	Same as V102	
V303 A,B	Same as V103	
V304 A,B	Same as V101	
V401	25008700 or	5AQP-1
	25008710 or	5AQP-2
	25008720 or	5AQP-7
	25008730	5AQP-11
V402 A,B	Same as V102	
V501	25000340	6AQ5
V502	25006490	1X2A
V601	25000220	5Y3-GT
V602	25000300	OA2

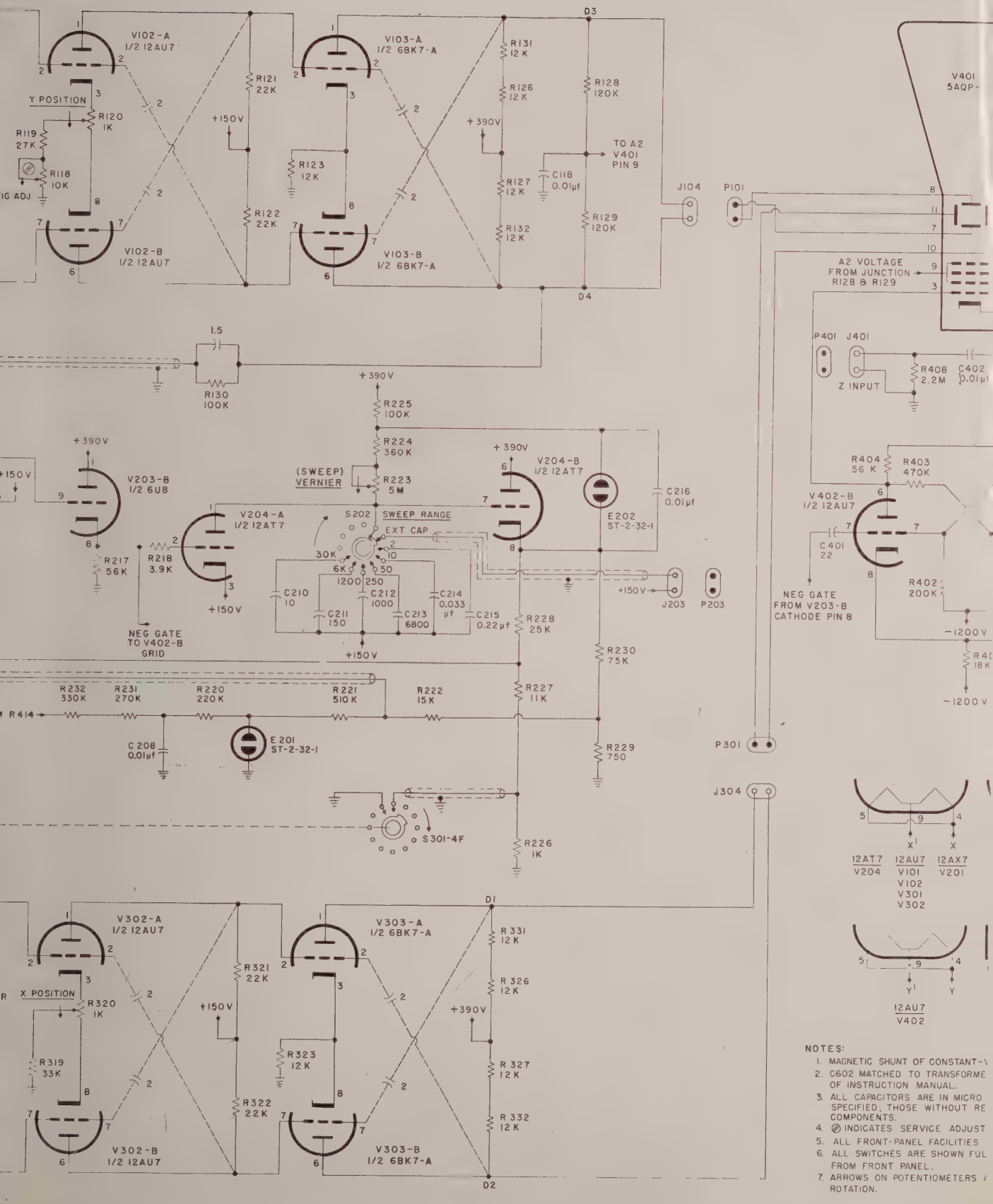
CABLE

W601	50110700	Power

* Yellow coded tubes only

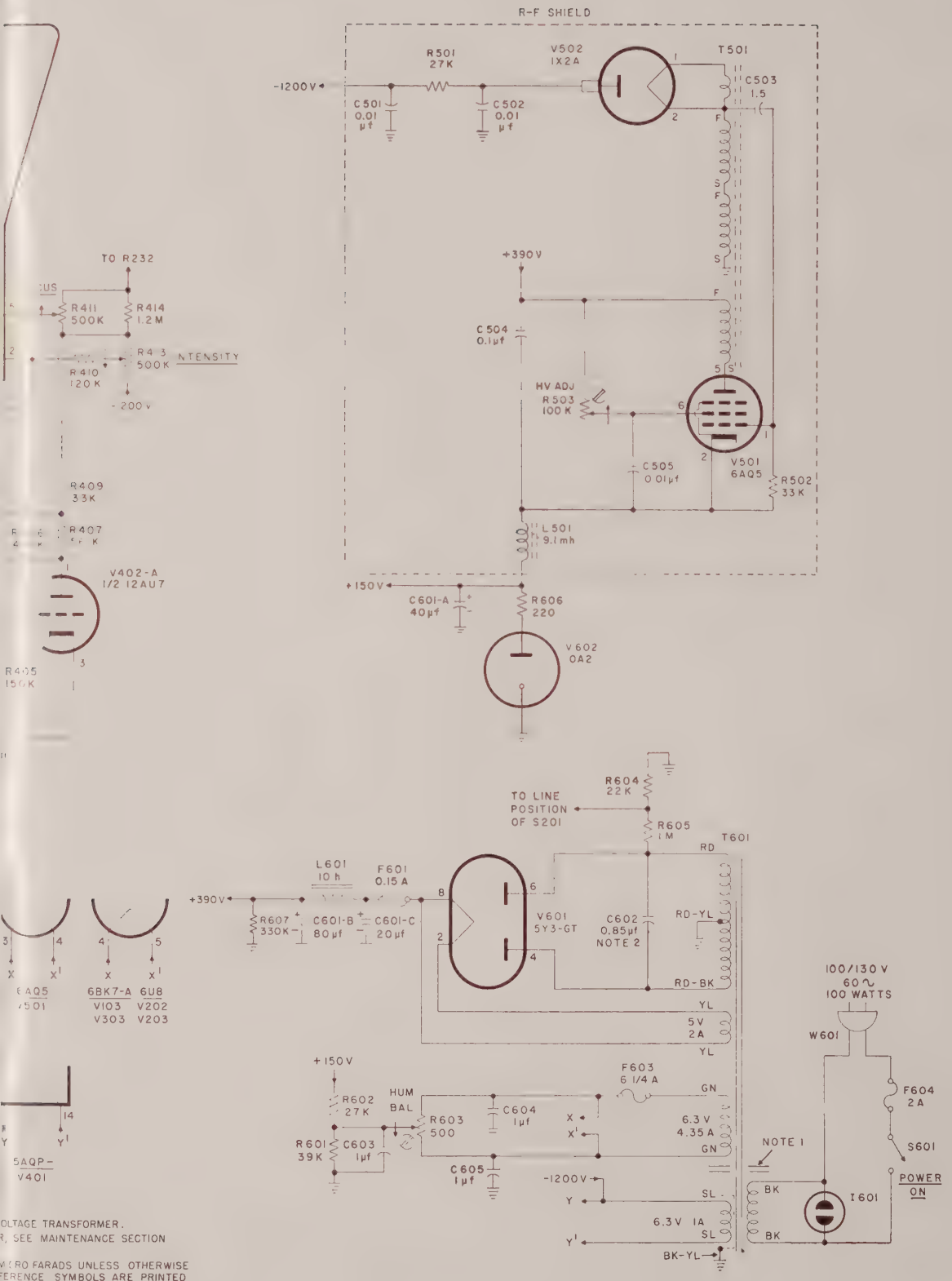

Y SELECTOR
C101 0.1μf
R101 2M
J101
Y INPUT J102
FOR BALANCED INPUT REMOVE LINK
J103
S101-2R
S101-2F
S101-1R
D-C
A-C
OFF
C105 1-12
C106 1-12
C107 1-12
R102 240K
C102 47
R103 20K
C103 820
R104 2K
C104 8200
V101 PIN 9
C119 0.7-3
C108 0.01μf
V101-A 1/2 12AU7-Y
R105 2M
R107 220K
Y D-C BAL
R110 1K
R109 1.2K
R106 2M
C109 0.01μf
R108 220K
V101-B 1/2 12AU7-Y
+150V
R111 22K
R114 100K
R113 33K
AMPLITUDE
C112 4μf
R112 22K
R115 1.2K
S201 SYNC SELECTOR
TEST SIG J202
R201 390K
INT
LINE
EXT
C201 1μf
EXT SYNC J201
LINE SYNC FROM JUNCTION R604 & R605
+150V
R205 10K
V201-A 1/2 12AX7
C203 0.47μf
C202 0.05μf
R202 2.2M
R204 18K
C204 0.47μf
R203 82K
+150V
R207 120K
V201-B 1/2 12AX7
R206 200K
SYNC AMPLITUDE
V202-B 1/2 6U8
R208 470K
V202-A 1/2 6U8
+150V
MODE
R213 10K
R209 47K
R210 1.2M
C207 47
R211 1M
R214 1M
R215 1.2M
V203-A 1/2 6U8
R212 12K
R219 330K
C205 10
S301-3R
S301-3F
X SELECTOR
C301 0.1μf
R301 2M
J301
X INPUT J302
FOR BALANCED INPUT REMOVE LINK
J303
SWEEP REC
DR
S301-2R
S301-2F
S301-1R
C305 1-12
C306 1-12
C307 1-12
R302 240K
C302 47
R303 20K
C303 820
R304 2K
C304 8200
V101 PIN 9
C319 0.7-3
C308 0.01μf
V301-A 1/2 12AU7-Y
R305 2M
R307 220K
X D-C BAL
R310 1K
R309 1.2K
R306 2M
C309 0.01μf
R308 220K
V301-B 1/2 12AU7-Y
+150V
AMPLITUDE
R314 100K
R311 22K
R313 33K
C312 4μf
R312 22K
R315 1.2K





NOTES:

1. MAGNETIC SHUNT OF CONSTANT-
2. C602 MATCHED TO TRANSFORME OF INSTRUCTION MANUAL.
3. ALL CAPACITORS ARE IN MICRO SPECIFIED; THOSE WITHOUT RE COMPONENTS.
4. ⊘ INDICATES SERVICE ADJUST
5. ALL FRONT-PANEL FACILITIES
6. ALL SWITCHES ARE SHOWN FUL FROM FRONT PANEL.
7. ARROWS ON POTENTIOMETERS / ROTATION.



OLTAGE TRANSFORMER.
R, SEE MAINTENANCE SECTION

MICRO FARADS UNLESS OTHERWISE
FERENCE SYMBOLS ARE PRINTED

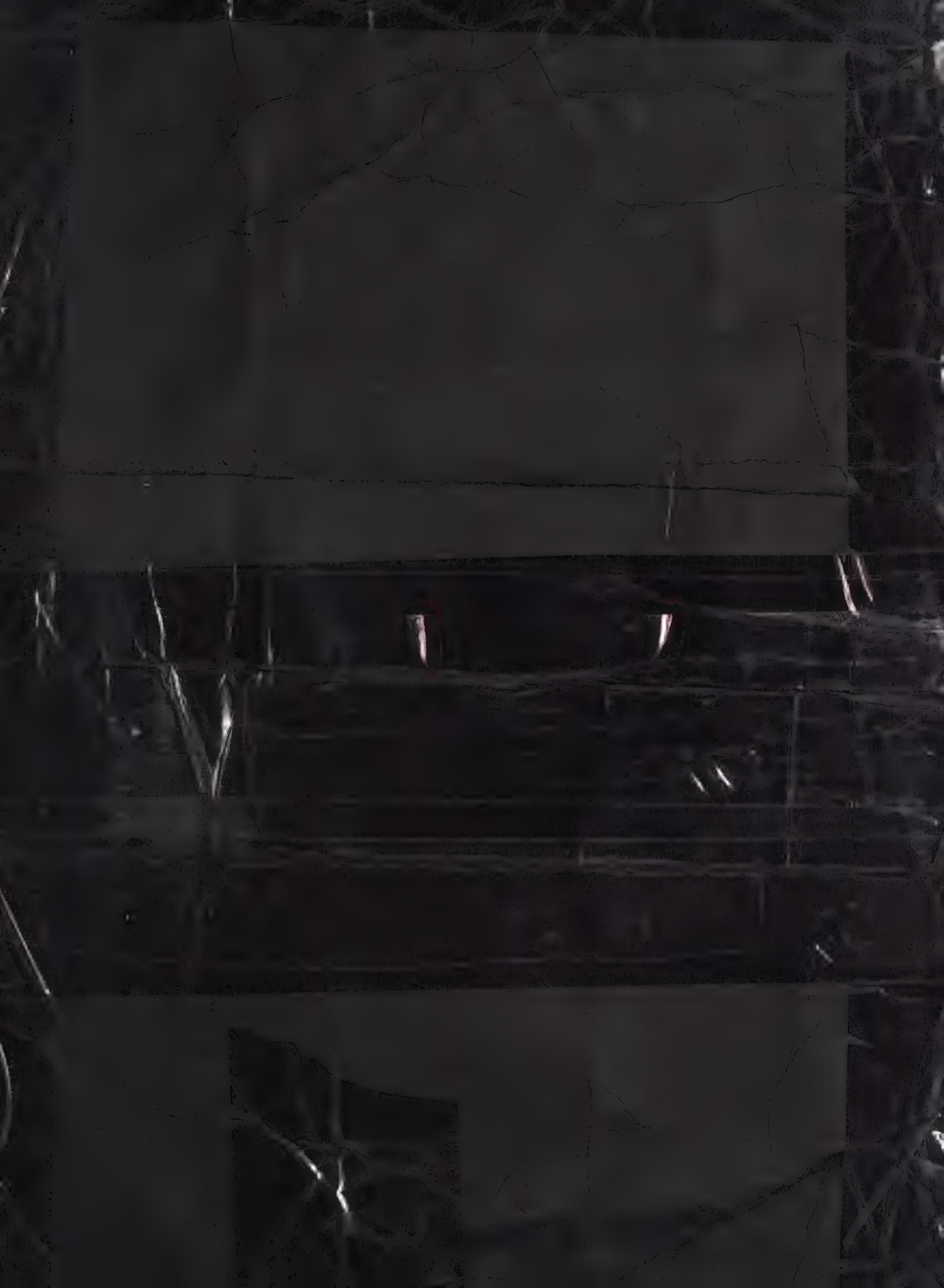
MENT.
ARE UNDERLINED.
LY COUNTERCLOCKWISE AS VIEWED

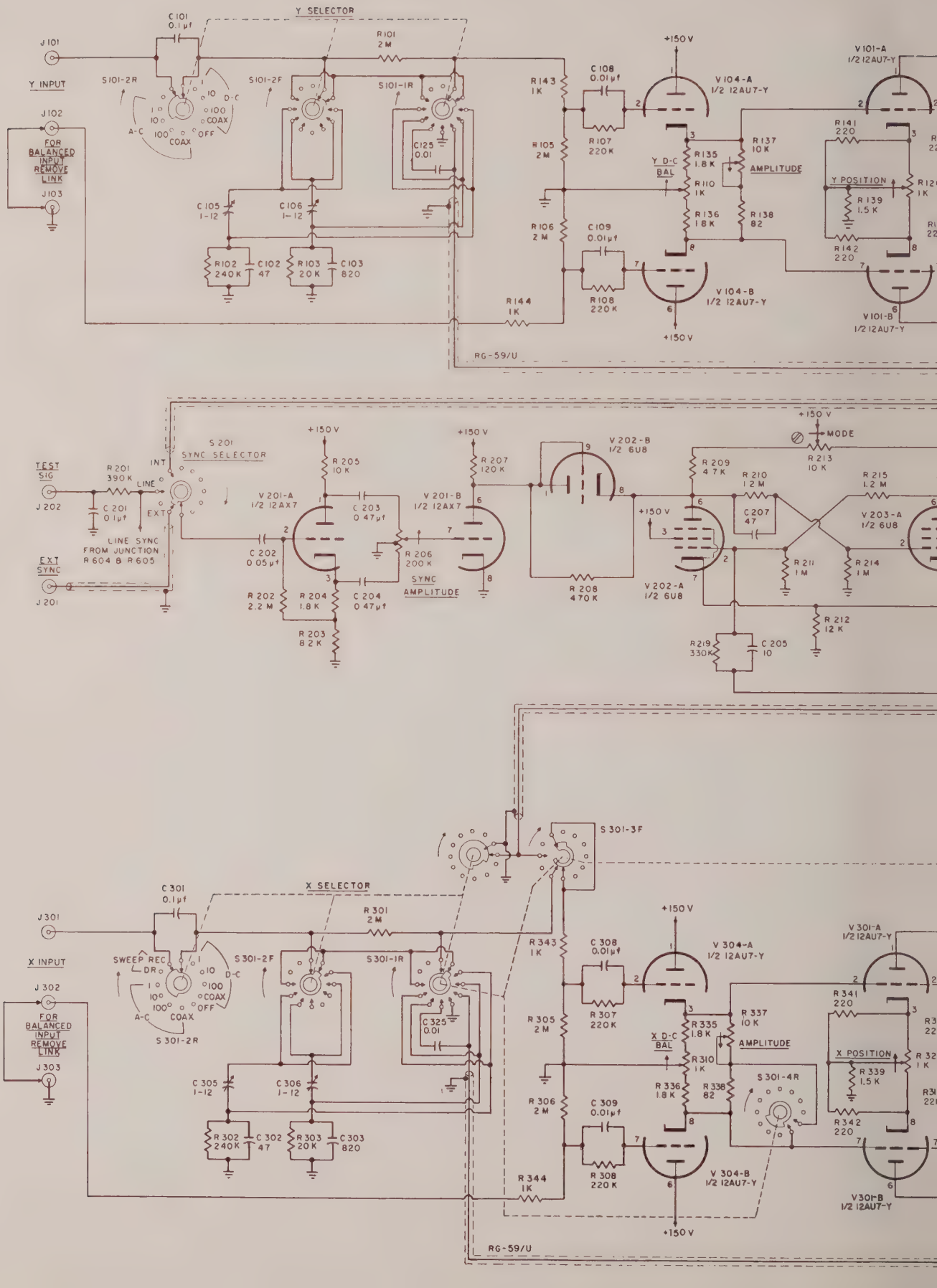
ND SWITCHES INDICATE CLOCKWISE

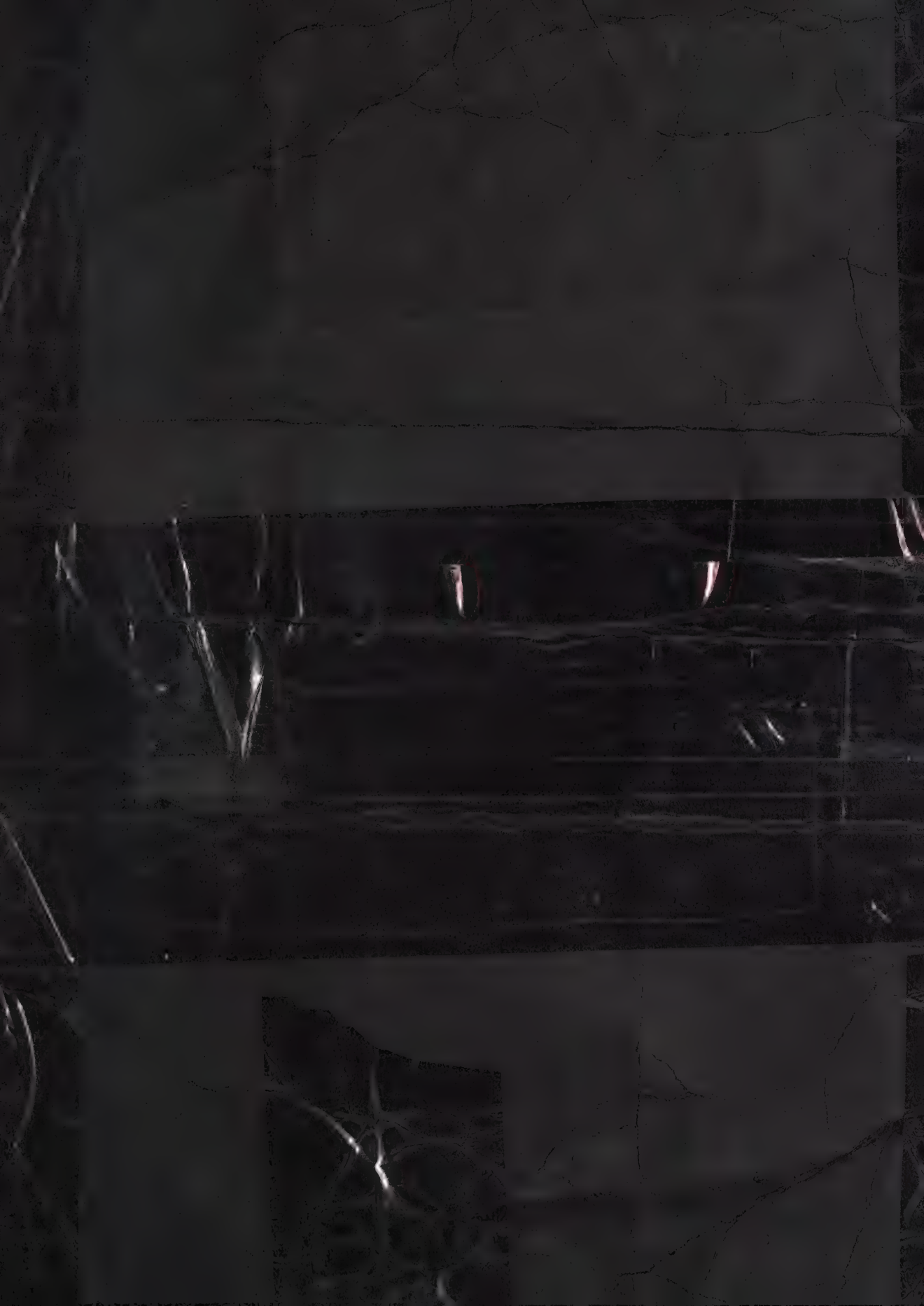
Schematic of Circuit

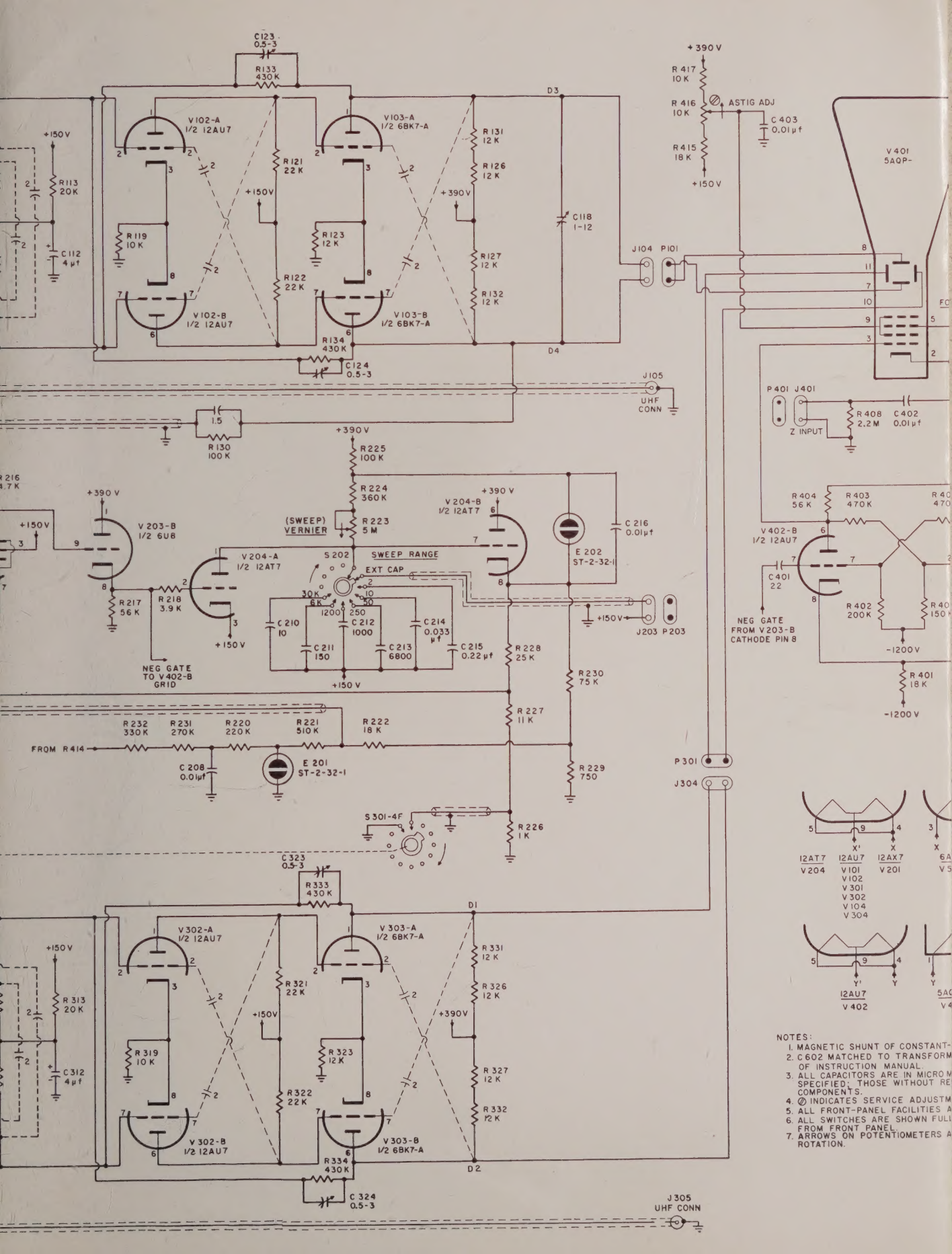
Du Mont Type 340 Cathode-ray Oscillograph

Ref. Drwg. 98000901-4




Y SELECTOR
J101
Y INPUT
J102
FOR BALANCED INPUT REMOVE LINK
J103
C101 0.1μf
R101 2M
S101-2R
S101-2F
S101-1R
A-C
D-C
COAX
OFF
C125 0.01
C105 1-12
C106 1-12
R102 240K
C102 47
R103 20K
C103 820
R143 1K
C108 0.01μf
R107 220K
R105 2M
R106 2M
C109 0.01μf
R108 220K
R144 1K
+150V
V104-A 1/2 12AU7-Y
V104-B 1/2 12AU7-Y
Y D-C BAL
R135 1.8K
R110 1K
R136 1.8K
R137 10K
AMPLITUDE
R138 82
V101-A 1/2 12AU7-Y
V101-B 1/2 12AU7-Y
R141 220
Y POSITION
R139 1.5K
R142 220
RG-59/U
S201 SYNC SELECTOR
INT
LINE
EXT
TEST SIG
J202
R201 390K
C201 0.1μf
LINE SYNC FROM JUNCTION R604 & R605
EXT SYNC
J201
V201-A 1/2 12AX7
V201-B 1/2 12AX7
R205 10K
R207 120K
C203 0.47μf
C202 0.05μf
R206 200K
SYNC AMPLITUDE
R202 2.2M
R204 1.8K
C204 0.47μf
R203 82K
V202-B 1/2 6U8
V202-A 1/2 6U8
R208 470K
MODE
R213 10K
R209 4.7K
R210 1.2M
C207 47
R211 1M
R214 1M
R215 1.2M
V203-A 1/2 6U8
R212 12K
R219 330K
C205 10
S301-3F
X SELECTOR
J301
X INPUT
J302
FOR BALANCED INPUT REMOVE LINK
J303
C301 0.1μf
R301 2M
SWEEP REC
DR
S301-2F
S301-1R
S301-2R
C325 0.01
C305 1-12
C306 1-12
R302 240K
C302 47
R303 20K
C303 820
R343 1K
C308 0.01μf
R307 220K
R305 2M
R306 2M
C309 0.01μf
R308 220K
R344 1K
V304-A 1/2 12AU7-Y
V304-B 1/2 12AU7-Y
X D-C BAL
R335 1.8K
R310 1K
R336 1.8K
R337 10K
AMPLITUDE
R338 82
S301-4R
V301-A 1/2 12AU7-Y
V301-B 1/2 12AU7-Y
R341 220
X POSITION
R339 1.5K
R342 220
RG-59/U




C123 0.5-3
R133 430K
V102-A 1/2 12AU7
V103-A 1/2 6BK7-A
R121 22K
R122 22K
R123 12K
R119 10K
R131 12K
R126 12K
R127 12K
R132 12K
C118 1-12
D3
D4
+150V
+390V
R113 20K
C112 4µf
V102-B 1/2 12AU7
V103-B 1/2 6BK7-A
R134 430K
C124 0.5-3
J105 UHF CONN
1.5
R130 100K
+390V
R225 100K
R224 360K
R223 5M
(SWEEP) VERNIER
V204-B 1/2 12AT7
C216 0.01µf
E 202 ST-2-32-1
V203-B 1/2 6U8
V204-A 1/2 12AT7
S 202
SWEEP RANGE
EXT CAP
30K
6K
1200
250
50
10
2
C210 10
C211 150
C212 1000
C213 6800
C214 0.033 µf
C215 0.22µf
R217 56K
R218 3.9K
NEG GATE TO V402-B GRID
+150V
J203 P203
R228 25K
R230 75K
R227 11K
R229 750
R226 1K
R232 330K
R231 270K
R220 220K
R221 510K
R222 18K
FROM R414
C208 0.01µf
E 201 ST-2-32-1
S 301-4F
P301
J304
+390V
R417 10K
R416 10K
R415 18K
ASTIG ADJ
C403 0.01µf
+150V
V 401 5AQP-
J104 P101
P401 J401
Z INPUT
R408 2.2M
C402 0.01µf
R404 56K
R403 470K
V402-B 1/2 12AU7
C401 22
R402 200K
NEG GATE FROM V203-B CATHODE PIN 8
-1200V
R401 18K
-1200V
C323 0.5-3
R333 430K
V302-A 1/2 12AU7
V303-A 1/2 6BK7-A
R321 22K
R322 22K
R323 12K
R319 10K
R331 12K
R326 12K
R327 12K
R332 12K
R313 20K
C312 4µf
V302-B 1/2 12AU7
V303-B 1/2 6BK7-A
R334 430K
C324 0.5-3
D1
D2
J305 UHF CONN
12AT7 V204
12AU7 V101 V102 V301 V302 V104 V304
12AX7 V201
12AU7 V402
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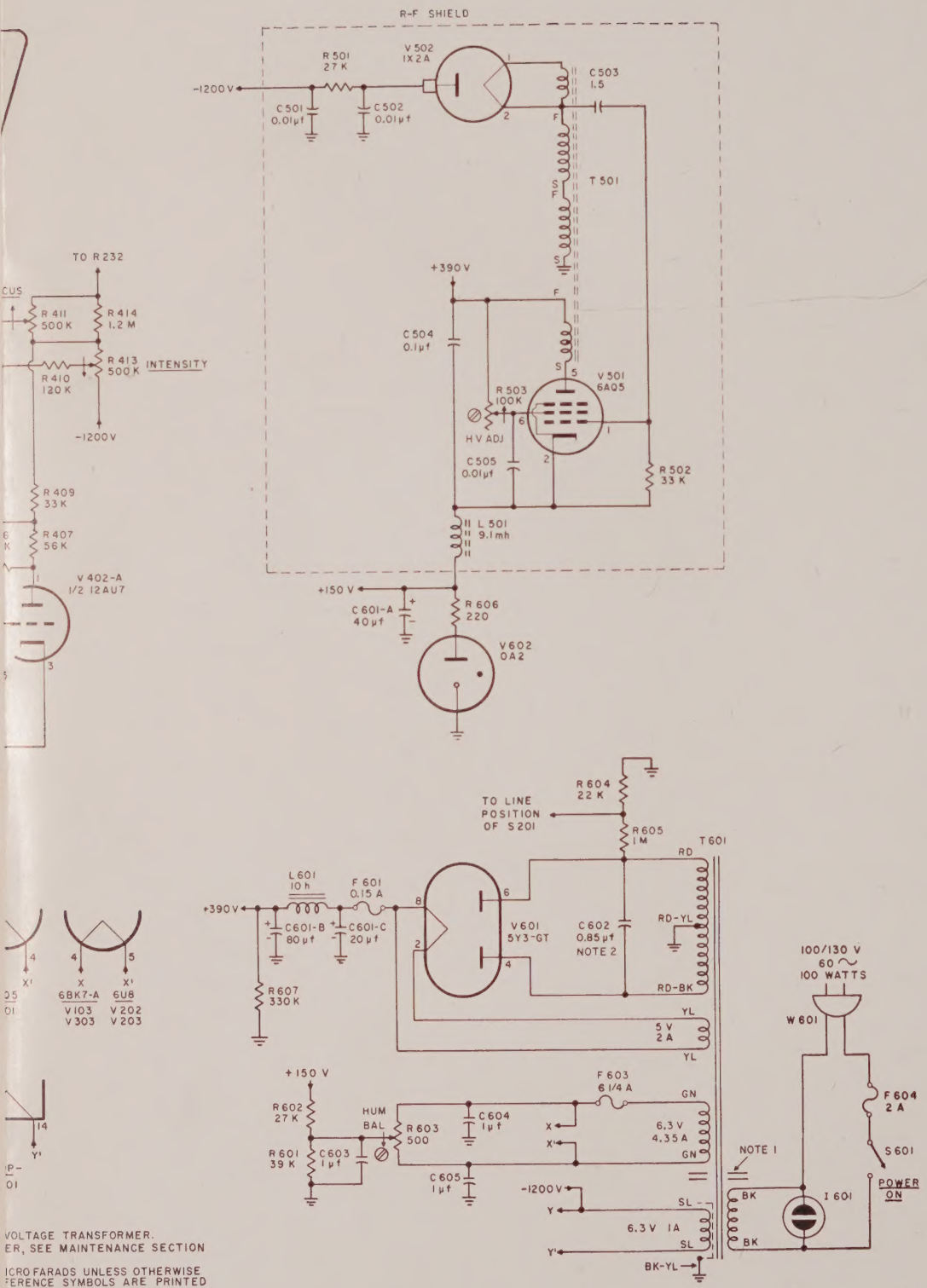
4. Ⓐ INDICATES SERVICE ADJUSTM
5. ALL FRONT-PANEL FACILITIES A
6. ALL SWITCHES ARE SHOWN FULL
FROM FRONT PANEL.
7. ARROWS ON POTENTIOMETERS A
ROTATION.



VOLTAGE TRANSFORMER.
ER, SEE MAINTENANCE SECTION

ICRO FARADS UNLESS OTHERWISE
FERENCE SYMBOLS ARE PRINTED

ENT.
RE UNDERLINED.
Y COUNTERCLOCKWISE AS VIEWED
ND SWITCHES INDICATE CLOCKWISE

Schematic of Circuit

Du Mont Type 341 Cathode-ray Oscillograph

Ref. Drwg. 98000904-4

WARRANTY AND SERVICE NOTICE
for
Industrial Type Cathode-ray Tubes and Instruments

DU MONT INSTRUMENTS

Each instrument manufactured by the Instrument Division of Allen B. Du Mont Laboratories, Inc., is guaranteed to equal or exceed its published performance specifications. It is further guaranteed against defective materials (other than the cathode-ray tube) and workmanship for a period of one year from date of delivery. Any defective instrument or an instrument that does not meet or exceed our specifications will, upon inspection by us, be repaired or replaced at our discretion should such defect appear within the guarantee period.

To register this guarantee, the enclosed guarantee card must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

DU MONT CATHODE-RAY TUBES

Industrial type cathode-ray tubes manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed for 1000 hours of operation or for a six-month period of installation, whichever shall first expire. The right is reserved, however, to limit claims to a period of nine months after shipment from the factory. Adjustments will be made on the merit of each individual claim because of the widely varying applications to which such tubes are subjected, and a tube which becomes defective during the guarantee period will be replaced ONLY AFTER INSPECTION AT THE FACTORY. Cathode-ray tubes which are sent in under the guarantee, must be sent with transportation paid.

BURNED OUT HEATERS AND BROKEN GLASS ARE NOT COVERED BY THE TUBE GUARANTEE

To register a tube guarantee, the guarantee card enclosed with the tube must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. TYPE NUMBER AND SERIAL NUMBER OF THE CATHODE-RAY TUBE MUST BE INCLUDED. The serial number of the tube will be found either on the glass stem of the electro-gun structure or on the bulb near the Du Mont brand. Tubes must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure factory service under our guarantees, the guarantee cards enclosed with all instruments and tubes must be properly filled out and returned. In all cases where service or adjustment is requested, please write first to the factory giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing in this respect, address:

Allen B. Du Mont Laboratories, Inc.
Instrument Service Department
760 Bloomfield Avenue, Clifton, New Jersey

The Instrument Service Department will then send to the customer, the written procedure for sending the instrument back to the factory. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the type number and serial number of the instrument and refer to the component by its symbol designation and description on the circuit schematic. This will help to expedite service.

DU MONT

Additional copies of this manual may be secured at a cost of two dollars each or twenty dollars per dozen copies; postpaid in the United States of America only.

Allen B. Du Mont Laboratories, Inc.

Instrument Division

760 BLOOMFIELD AVENUE, CLIFTON, NEW JERSEY